



PARAGON
ARCHITECTURE



PROJECT MANUAL

CASSVILLE R-IV SCHOOL DISTRICT

CASSVILLE PERFORMING ARTS
CENTER

1825 State Hwy Y
Cassville, MO 65625

Project # 21-620

Issue Date | May 17, 2023

PROJECT MANUAL

PROJECT:

CASSVILLE PERFORMING ARTS CENTER
1825 State Hwy Y
Cassville, MO 65625

OWNER:

CASSVILLE R-IV SCHOOL DISTRICT
1501 Main Street
Cassville, MO 65625

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CIVIL ENGINEER OF RECORD: OLSSON ASSOCIATES

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ARCHITECTURAL SPECIFICATION DISCLAIMER

PROJECT: 21-620: Cassville Performing Arts Center
OWNER: Cassville R-IV School District
LOCATION: 1825 State Hwy Y, Cassville, MO 65625

ARCHITECT: PARAGON ARCHITECTURE, LLC
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PROJECT: CASSVILLE PERFORMING ARTS CENTER
OWNER: CASSVILLE R-IV SCHOOL DISTRICT
LOCATION: 1501 MAIN STREET
CASSVILLE, MO 65625

CIVIL ENGINEER: OLSSON, INC.
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PROJECT: Cassville HS: Performing Arts Center
OWNER: Cassville School District
LOCATION: 1825 State HWY Y
Cassville, MO 65625

ENGINEER: RTM ENGINEERING CONSULTANTS, LLC
3045 S. KANSAS EXPY
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P: 417-708-9315

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- 03-30-00 CAST-IN-PLACE CONCRETE
- 05-40-00 COLD-FORMED METAL FRAMING
- 06-10-00 ROUGH CARPENTRY
- 06-15-00 WOOD DECKING
- 13-34-19 METAL BUILDING SYSTEMS



SPECIFICATION
DISCLAIMER

PROJECT: Cassville Performance Arts Center
OWNER: Cassville School District
LOCATION: 1825 State Highway Y
Cassville, Missouri 65625
ENGINEER: RTM Engineering Consultants
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PROJECT: CASSVILLE PERFORMING ARTS CENTER
OWNER: Cassville R-IV School District
LOCATION: 1825 State Hwy Y, Cassville, MO 65625

CONSTRUCTION MANAGER: RE Smith Construction Company, Inc.
1036 W. 2nd St., Joplin, MO 64801
P: 417.623.4545

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CASSVILLE R-IV SCHOOL DISTRICT:

CASSVILLE PERFORMING ARTS CENTER

SECTION 00 11 13 – ADVERTISEMENT FOR BIDS

YOU ARE HEREBY INVITED TO PROVIDE PROPOSALS FOR THE FOLLOWING PROJECT:

Cassville R-IV School District :

Cassville Performing Arts Center

For The Owner:

**Cassville R-IV School District
Cassville, MO 65625**

To The Construction Manager:

**RE Smith Construction Co.
1036 W. 2nd St.
Joplin, MO 64801
(417) 623-4545**

THE PROJECT:

The Project Site is located at 1825 State Hwy Y at the existing site of the Cassville High School in the city of Cassville, state of MO and county of Barry .

The CM is soliciting bids for this project through multiple bid packages from subcontractors. Refer to Scopes of Work in Section 00 20 00.

The Project is construction of a new Performing Arts Center for the Cassville School District located on the South side of the High School located at 1825 State Hwy Y, Cassville, MO 65625. The project consists of Site Demo, Site Grading, Site Utilities, Asphalt Paving, Concrete, Structural Steel, Metal Stud Framing, Rough Carpentry, Doors, Windows, Hardware, Overhead Doors, Gypsum Board, ACT Ceiling, Flooring, Painting, Specialties, Auditorium Seating, Pre-Engineered Metal Building with Standing Seam Roof and Metal Wall Panels, Fire Sprinkler, Plumbing, HVAC, and Electrical.

PRE-BID:

A pre-bid meeting will be held June 29, 2023 @ 10:30 AM at the project Site , 1825 State Hwy Y, Cassville, MO 65625. Check-In at the High School lobby and attendees will be escorted to the appropriate room. An in-person site review of all work of this project will occur after.



CASSVILLE PERFORMING ARTS CENTER

BID PERIOD:

Bid Packages <June 16, 2023 through July 13, 2023>

BIDDING:

Sealed Bid Package proposals for the **Cassville Performing Arts Center** project shall be received at:

Cassville R-IV School District
Central Office
1501 Main Street, Cassville, MO 65625
Attn: Clint Walton
RE Smith Construction Company

Bidding:
Cassville Performing Arts Center
Bid Package _____

no later than **10:30 a.m. Central Time, July 13, 2023**. See Section 00 21 13 Instructions to Bidders for more information. Bids will be opened and read publicly. The Bid Form, all bid submittal requirements must all be received as described herein and in Section 00 19 00 Submission for Bids and Instruction to Bidders to be considered a Qualified Bid Proposal.

The bidders understand that the CM and the Owner reserves the right to award the contract to the **best responsible bidder**, and to reject any or all bids and/ or to waive any and all technicalities or informalities in the bidding. (Refer to Division 00 documents for a clarification on evaluating lowest responsible bidder). No bids may be withdrawn for a period of **thirty (30)** days subsequent to the specified time for receipt of bids.

BID DOCUMENTS, DRAWINGS AND SPECIFICATIONS:

Bid Documents, Drawings and Specifications and other related contract information have been provided to the following locations:

**Engineering Reprographics, Springfield, MO (417-869-2222)

**RE Smith Construction; www.resmithconst.com (417-623-4545)

**Hard Copies of plans and specifications and other related contract information may be obtained at the bidders own expense through any of the above ** marked locations, or as the bidder so chooses.



CASSVILLE R-IV SCHOOL DISTRICT:

CASSVILLE PERFORMING ARTS CENTER

Any questions related to Bid Document procurement or clarifications are to be directed to the CM:

RE Smith Construction Company

Attn: Clint Walton

estimating@resmithconst.com

1036 W. 2nd Street

Joplin, MO 64801

(417) 623 4545

RETAINAGE:

The Owner shall retain an amount of 5% of the cost of construction throughout the Construction Period. The retainage will not be reduced during the project and will only be released as a part of the CM's final pay application.

PREVAILING WAGE:

This project DOES comply with the current MO DOL Prevailing Wage Order for Barry County, MO #29. See Section 00 51 00 for Wage Order.

TAX EXEMPT STATUS

BIDS SHALL NOT include Sales tax on material.

PERFORMANCE AND PAYMENT BOND:

A Performance and Payment Bond may be required of the successful bidders in the amount of 100% of the contract amount. The bond amounts will need to be listed on the bid form in the space provided. It shall not be included in the Bid Package total Base Bid or Alternate(s).

WITHDRAWAL OF BIDS:

Bids may not be withdrawn for a period of (30) thirty days.

DAMAGES:

Real Damages/Delay Damages in the amount of \$500.00 per calendar day and Liquidated Damages in the amount of \$1,000.00 per calendar day may be assessed every day that work is not completed per the Construction Schedule and after the scheduled final completion date is not achieved.

END OF SECTION 00 11 13



CASSVILLE PERFORMING ARTS CENTER

SECTION 00 19 00 - SUBMISSION OF BIDS

ALL BIDS ARE DUE NO LATER THAN 10:30 a.m. CT on July 13, 2023 as follows:

1. **Hand Delivered and Mailed Bids** are to be delivered:
 - a. In a Sealed envelope bearing the following:

Cassville R-IV School District
Central Office
1501 Main Street, Cassville, MO 65625

Attn: Clint Walton
RE Smith Construction Company

Bidding:
Cassville Performing Arts Center
BID PACKAGE _____

- b. Include the Bid Form Section 00 41 00 filled out in its entirety.
 - c. BE SURE to Fill Out your Bid Package Bidding on the Envelope.
2. No other bidding types will be accepted.

END OF SECTION 00 19 00



CASSVILLE R-IV SCHOOL DISTRICT:

CASSVILLE PERFORMING ARTS CENTER

SECTION 00 20 00 - SCOPES OF WORK (BID PACKAGES)

SCOPES OF WORK (BID PACKAGES)

Common Requirements	Provisions (Applicable to <u>ALL</u> Bid Packages)
Bid Package 03	Concrete
Bid Package 08	Storefronts/Glazing
Bid Package 08A	General Trades
Bid Package 09	Metal Studs/Gyp Board/Ceilings/Insulation
Bid Package 09A	Flooring
Bid Package 09B	Painting
Bid Package 12	Seating
Bid Package 21	Fire Suppression
Bid Package 22	Plumbing
Bid Package 23	HVAC
Bid Package 26	Electrical
Bid Package 31	Site Work/Site Demolition/Site Utilities
Bid Package 32	Asphalt Paving

Common Requirements

Provisions (Applicable to ALL Bid Packages)



CASSVILLE PERFORMING ARTS CENTER

A. The Common Requirements Section is to be included by ALL Bid packages and include, but are not limited to the following:

1. You are bidding on a project that is under a Construction Management at Risk contract. The Construction Manager at Risk is RE Smith Construction Co. If your company enters into an agreement with RE Smith Construction all requirements of this section will be included in your agreement. RE Smith Construction **will not** enter into any agreement with Subcontractors or Suppliers who have in the past displayed unethical behavior or business practices or who supports unethical or illegal behaviors or business practices. One example of unethical behavior is if a company provided a deduct cost on an alternate on the bid day bid form and then in the future is asked for the deduct and the company provides less than the bid day deduct amount.
2. Your bid shall include all items per plans and specifications for a complete system unless noted otherwise. If you would like to provide a product that is not listed in the plans or specifications as an equal, you must do so during the bidding period and get approval to use said product from the Architect and/or the Construction Manager (furthermore known as CM) via addendum.
3. **NO ESCALATION COSTS, SURCHARGE(S) FEE(S), ADD DELIVERY FEE(S), MATERIAL INCREASES, LABOR INCREASES, EQUIPMENT COST INCREASES ETC.** will be paid after the time of the bid. It is the Subcontractors responsibility to include any and all cost increases that may occur during the project in their proposal pricing.
4. **FORCE MAJURE IS NOT IN PLACE ON THIS PROJECT OR IN THIS CONTRACT.**
5. **ALL COSTS SHALL BE HELD FOR 30 DAYS AFTER BID OPENING.**
6. **It is the intent of the Owner and the CM to issue The Notice to Proceed within one week of the bid opening so that submittals may start and time sensitive materials can be ordered and ready for Construction start in August of 2023.** If the Notice to proceed is delayed the project schedule will be amended accordingly with no detriment to Owner or CM.
7. Substantial Completion is scheduled for August 1, 2024.
8. The CM's Project Manager, as assigned, shall be the Final Decision Maker on all matters concerning the CM's documents.
9. Testing and Inspections is managed by the CM through a held allowance for the Owner.
 - a. All Subcontractors are to notify the CM at least 24 hours in advance for ALL tests per plans and specs that require third party testing
 - b. If it is necessary, by no fault of the Owner or CM, to re-test/re-inspect due to a Subcontractors' inability to perform as required or initial test is non-conforming, the cost of the re-test/re-inspection will bear solely on the Subcontractor.
10. Temporary electric power, temporary water, temporary HVAC and dehumidification will be in place as needed and as provided in relative Bid Packages and specifications.
11. Excessive use of any on-site utilities will not be tolerated and the CM reserves the right to charge Subcontractor's or terminate the use of the utility (ies) for said Subcontractors.



CASSVILLE PERFORMING ARTS CENTER

- Excessive use includes but is not limited to faulty water hoses, electrical devices that remain on while not in use, etc.
12. The Electrical Bid Package, Bid Package 26 will Provide and maintain interior temporary lighting as required by provisions of OSHA CFR 1926 Subpart D standard number 1926.53 (Table D-3). Subcontractors working outside the interior building envelope will be required to provide their own temporary lighting as required for their bid package to be completed with-in the project schedule.
 13. The HVAC Bid Package 23 is responsible for HVAC and Humidity control during construction and SHALL ONLY be allowed to utilize the new HVAC equipment if it is first, available and operating properly when needed and/or directed by the CM (if it is not then TEMP HVAC and Humidity control is required to be provided and maintained as needed and directed by the CM), second all warranties are maintained 100% according to specification and the manufacturer. The HVAC subcontractor and Electrical subcontractor will include in their bids ample manpower, material and equipment to provide unloading, relocating, hooking-up, powering, etc. the Temporary HVAC & Humidity Control unit(s) and device(s). The CM reserves the right to bring in Temporary HVAC and Humidity control units and Backcharge the subcontractor the full costs for management of and securing and paying for the needed units as they see fit to maintain proper temperatures and humidity throughout the project as required for work to complete as needed. The CM will provide the BP 23 Subcontractor with a minimum of 96 hours notice prior to need for the Temporary Units and provide 24 hours notice prior to the CM using its means of bringing in Temporary Units. Be it clear that the BP 23 Subcontractor is responsible for HVAC and Humidity Control 100% in all areas at all times for the entire project as and when directed by the CM and only when the CM deems it necessary by notice described above will the CM take over this responsibility and Backcharge the BP 23 Subcontractor.
 14. The CM will provide temporary toilets and dumpsters as required for construction.
 15. It is every Subcontractors responsibility to clean-up all work areas of their own debris/materials as was created by their work throughout working times. Final Clean-Up is a shared responsibility of the CM and the Bid Package 08A Subcontractor.
 - a. Trash/debris is to be collected by the Subcontractor and deposited into jobsite dumpsters (provided by the CM) as required daily or as directed by the CM. This includes broom or hand sweeping of each work area. Excess or extra materials that have not been installed shall be neatly organized and arranged in areas that do not disrupt the flow of work or the work of others. As necessary include the cost of onsite or offsite storage locations for your materials and equipment and include requirements for moving excess or extra material out of the building/area when not needed and back-into the building/area when needed.
 - b. All conveyance, moving and transporting of Construction debris/excess materials or materials not yet in place will be the responsibility of the Subcontractor.
 16. All Layout and staking as required to complete this bid package in its entirety. CM will provide 3 control points and 1 benchmark only.
 17. Shoring, blocking, bracing etc. necessary to complete any work with-in their respective Bid package is the sole responsibility of that subcontractor.



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18. All excavations are to be per Safety Requirements, OSHA and R.E. Smith Construction Safety Policies.
19. Coordinate with the CM and other trades as necessary to ensure the overall project schedule is met.
 - a. Includes but not limited to
 - i. Progress Meetings
 - ii. Work in place
 - iii. Pre-Installation Meetings
 - iv. Submittals
 - v. RFI's
 - vi. ASI's and SI's
 - vii. PR's and CO's.
20. Coordination and requirements in purchasing and maintaining of any and all permits, inspections, verification, utility locates, tap fees as needed and requirements of and by any and all State, Federal and Local Authorities Having Jurisdiction.
21. This Job Site is NON-SMOKING/NON-VAPING and any person(s) violating this requirement shall be subject to a \$100 fine/occurrence. THERE WILL BE NO WARNINGS for this offense and the Subcontractor company will be Backcharged for their employees offense without prejudice.
22. This job will utilize a project website/web based platform (similar to Procore/Submittal Exchange) for all Construction Document Collaboration; Submittals, RFI's, PR's, ASI's/SI's, Meeting Minutes, Schedules, Pay Apps, Closeout Documents, other items deemed necessary by CM. It is the responsibility of all bidding entities to be familiar with or to become familiar with navigating and utilizing the project website that is in place for the project.
 - a. All information will be available to all subcontractors on the web-based platform and it is the Subcontractors responsibility to respond with-in 48 hours to the CM of any costs associated to newly uploaded ASI's, SI's, PR's, Pricing Requests, etc within the time frame provided or no later than 5 business days after the document is released. After 48 hours a no cost change will be entered for the Subcontractor if no response is received or the CM may utilize RS Means or other work cost based program to provide the credit or add on the Subs behalf. Any additional costs associated with the work of the Bid Package will bear solely on the Subcontractor. The Subcontractor shall be required to do the work required as requested in the document. IF work is requested on a Time and Material (T&M) basis, the Subcontractor shall provide upon completion or at weekly intervals a culmination sheet that shows the total of the work complete or to date. It shall include all material tickets, invoices, time cards, equipment rental forms/invoices, ALL documentation that is needed to show that the work being done on the T&M basis adds up to the subtotal amount. Mark-up will be shown at the bottom after the subtotal and the total shall be ALL LABOR, MATERIAL AND EQUIPMENT plus MARKUP as TOTAL.



CASSVILLE PERFORMING ARTS CENTER

23. Plans and Specifications are available for viewing/download at the locations described in the Project Manual.
 - a. Plans and Specifications will be available for view and download on the project website after bidding for awarded subcontractors.
 - b. Any and all costs that arise from the Subcontractor procuring Plans and/or Specifications fall directly on the Subcontractor.
24. Submittals are considered here-in to be time sensitive where-in all submittals need to be collected by the Subcontractor per specific sections included in their relative scopes of work and uploaded to Procore/Submittal Exchange, Submittal Tab in the correlating section no later than by the dates set in the Submittal Schedule but no later than 21 days after the NTP date. IN cases when the project website is not set-up the Subcontractor shall email the CM's Project Manager the submittals in .pdf form. It is the responsibility of the Subcontractor to submit their submittals and track approvals and order and have on hand products well in advance of other work that requires the subject submittal to be installed or needed for coordination. Time required by the CM to work overtime or outside of normal project work times (8am-5pm, Monday – Friday excluding Holidays) will constitute a back charge to the Subcontractor in the amount of \$275.00 per submittal. This charge will also be levied if a submittal is rejected and must be resubmitted more than 1 time.
 - a. Submitted items (as a submittal) shall be provided in ONE .pdf document not multiple files or different file types. If the CM has to compile the Subcontractor's submittal into 1 document to comply with this paragraph, the CM will backcharge the Subcontractor a flat fee of \$200.00 per submittal item.
25. Include all Safety Requirements including but not limited to, OSHA, R.E. Smith Construction Company other Authorities having Jurisdiction and are to be adhered to at all times. Fall Protection is the duty of each individual Subcontractor until such time as temporary or permanent guardrails are in place.
 - a. Safety is of the utmost concern to R.E. Smith Construction and unsafe acts will not be tolerated.
 - i. Unsafe conditions shall be reported to the CM's Site Superintendent immediately.
 - ii. Unsafe Practices shall be reported to the CM's Site Superintendent immediately.
 - iii. Hard Hats and Safety Glasses (ANSI Z87.1) are required at all times. No shorts, tennis shoes, cut-off t-shirts or other inappropriate attire will be permitted.
 - iv. High-Reflectivity jacket, vest or shirt must be worn at all times on site.
 - v. Company Name of employer shall be visible and readable on attire (Shirt, jacket, vest etc.) for all employees at all times while on RE Smith Construction Project site.
26. All Subcontractors, Subcontractors employees, Subcontractors Third-Tier Subcontractors, Visitors etc. before coming on site must have on adequate PPE (Hard Hat and Safety Glasses, High-Reflectivity vest/shirt minimum) and will be required to take part in the



CASSVILLE PERFORMING ARTS CENTER

- CM's Sign-In and Sign-out Program. The CM's Superintendent manages this program on site and it is imperative that all employees complete the program's daily requirements. Not doing so will result in delay damages and payment being withheld until such time as employees working on site can be verified completely.
27. This job requires all employees of all Subcontractor Companies performing work to have at minimum a 10 hour OSHA construction hazard training class. The class is to be approved by OSHA and the employee must maintain on their person or in close proximity proof of such training.
 - a. Employees will be required to show at start of work, proof of the training and this information will be recorded on site. The Subcontractor must also provide this information to R.E. Smith Construction prior to employees doing work.
 28. Include all requirements of the Subcontract between R.E. Smith Construction Company and the Subcontractor as included in Attachment. No changes to the contract will be allowed. After execution of the contract or after the Notice to Proceed has been sent to the Subcontractor, the CM may at any time direct the Subcontractor to do extra work and the CM has sole discretion as to whether extra work is done on an invoice or as a Change Order. Email approvals from the CM's Project Manager to the Subcontractor shall be approved and work shall proceed the same as if there was a signed copy of the Change.
 29. Any Safety related item installed by other Bid Packages that needs to be removed, moved, altered etc. to allow work of this Bid Package, it is to be removed by this Bid Package and re-installed in the appropriate previous manner after this Bid Package work is complete in subject area.
 30. No exclusions to a bid package will be allowed. If any exclusion is listed on a bid form, the bid will be identified as non-responsive and the CM reserves the right to reject.
 31. It is the responsibility of the installing subcontractor to approve the substrate on which their product is being installed prior to installing. Painters will prime walls/ceilings/work 1 time and then point out defects that require fixing to the substrate installer via the CM's superintendent before work will commence. The Painter will then re-prime the entire wall/ceiling area before commencing with next coats. Painter is required to provide 3 coats paint (1 primer and 2 finish) at minimum or as specified for this project. All other Subcontractors are to verify that the substrate is approved prior to their commencing with any work on top of or adjacent to the substrate.
 32. ALL WORK that is done/ongoing/completed/in-process after the tape & finish process of gypsum board shall be 100% dustless. Examples include ceramic tile cutting, floor grinding prior to patch, during patch etc.
 33. Hoisting, Conveying, Moving of all material, tools, equipment etc. is the duty of each Subcontractor for their own scope of work.
 34. Where/When/If the word Contractor, General Contractor or similar is written in the plans and/or specifications this will mean to be by the Sub-Contractor of that Scope of Work/Bid Package. All work of this project is included in the Bid Packages except those items expressly written as by the CM or Owner. If an item or items are not specifically included in a Bid Package the work in question shall be included in the relevant Bid



CASSVILLE PERFORMING ARTS CENTER

- Packages/Scopes of Work as can be reasonably inferred by similar work of the project and the CM will make this call as Final Decision Maker.
35. Subcontractors and Suppliers are responsible for providing the most stringent in any case of any discrepancies found in the project documents so that the Architect and CM, if any instances are brought into question, can decide between the two instances.
 36. Subcontractors may be required to include the cost of their performance and payment bond. Include this amount in the location indicated on the bid form in the amount of 100% of the contract sum. If proposal is accepted and Bonds are required they shall be on the standard form of the AIA Document A312 with such Sureties as may be approved by the CM and the CM shall be the Bond Holder.
 37. Bids shall be made on the Bid Form included in the project manual.
 - a. Bids shall be submitted as discussed in the project manual.
 38. A Preliminary Construction Schedule from the CM will be provided as soon as possible. It is imperative that each Subcontractor reviews the schedule as failure to meet the schedule will result in the Subcontractor being held responsible for Liquidated and/or Real and/or Delay Damages as indicated in the project manual. This schedule will be revised at each progress meeting throughout the project and Subcontractors are to adhere to the dates as scheduled.
 - a. Subcontractors shall provide their own project schedule at maximum 7 days after a NTP is sent to them by the CM. Subcontractors will provide their schedule to the CM showing critical path items with durations and relationships and dependencies to other works/subcontractors work, lead times for their material and alert the CM to long lead items. They will have input on items of the project schedule as made by the CM, as the Schedule of Values will mirror the Project schedule, as well as progress meetings but the completion date is set and the CM will ultimately schedule as appropriate to meet this deadline and the subcontractor will complete their work in and by the time frame as scheduled and contracted. It is the subcontractor's responsibility to be ready to and start work when it is needed on the project regardless of being notified by the CM.
 39. On projects mandated by Prevailing Wage or the Davis Bacon Act: Certified/Signed payroll reports will be required of ALL WORKERS who perform work on this project and will be submitted in duplicate each week after work occurs and with the current month's payment applications.
 - a. If no work occurs for a certain week but the Subcontractor has worked previous weeks, A "NO-WORK" week payroll report will be sent.
 40. Payment Applications:
 - a. All Pay Apps will be completed utilizing PROCORE.
 - b. Schedule of Values:
 - i. A Schedule of Values is required to be submitted to the CM within 7 calendar days after the Notice to Proceed or contract receipt, whichever is sooner.



CASSVILLE R-IV SCHOOL DISTRICT:

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1. The SOV will be approved by the CM and at that time the Subcontractor shall enter their Breakdown and Values (SOV) into their SOV on Procore for FINAL CM approval.
- c. Once approval is received from the CM, the Subcontractor is then able to bill, barring all other requirements of the contract have been met.
- d. All Material and/or Lower-Tier Subcontractor Invoices for the current pay period must accompany each Pay Application.
- e. Partial or Full Lien Releases/Waivers must accompany the Pay Application starting with Pay App #2 and must be on the Approved Subcontractor Supplier List. Lien Releases from payments received or from work completed being billed for must be provided by all suppliers or lower-tier subs as well as for the Subcontractor itself.
- f. If stored material is being billed (stored material = material stored off-site that will be installed as work-in-place at a later date), the subcontractor will bill for only that amount of material and only the overhead cost required to procure and store the material with no mark-up and provide to the CM the following documentation:
 - i. Invoices for ALL material being billed as stored in a legible fashion showing the value of all billed for stored material including an inventory list showing the material items, the value of each item and at the bottom of the list showing the value of the overhead cost.
 - ii. Non-negotiable Bailment Receipt (when required).
 - iii. Pictures of ALL material being billed as stored.
 - iv. A Right of Entry listing the CM, the Architect and the Owner as allowable companies with individuals approved as deemed necessary by the entity are able to come on the premises where the stored material is being stored, inventory and take pictures as necessary and review the material as necessary to verify that the stored material being billed is indeed in place at the location.
 - v. Certificate of Insurance showing/stating that the value of the material being stored is covered + 50%, that the location where the material is being stored is insured for the above stated value.
41. Progress Meetings will be held bi-weekly or as needed and a representative from each Subcontractor whose work will be starting in the next two weeks is required to attend. After the initial meeting the Subcontractors representative will be required to attend all Progress Meetings until 1 month after the Subcontractors work is completed or Final Completion is met whichever is first. The CM may call for a Subcontractor to come ahead of or after the Subcontractors initial/last meeting date if deemed necessary. **The representative in attendance must be able to speak for and make decisions on behalf of the Subcontractor Company.**
42. The Subcontractor must be able to maintain sufficient manpower, tools, equipment etc. to meet the Construction Schedule including overtime, night, weekend, holiday work, etc.
43. Cold/Hot Weather Protection as required is to be included.



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44. Time lost due to weather conditions must be made up by Subcontractors as the CM directs.
45. The Subcontractor, at all times, must have on site a Competent Person, Superintendent or Foreman whom which the CM can discuss day to day activities and who has the authority to make company level decisions concerning manpower, equipment and material for their Scope of Work.
46. Parking will only be allowed in designated areas as approved by the CM.
 - a. Light Duty Trucks, Vans, SUV's and Cars will be only allowable vehicles
 - b. Any unauthorized parking will result in a \$100.00 fine multiplied per offense up to 3, where-in after the subject vehicle will be towed at the vehicle owner's expense.
47. A Designated area for consumption of food and beverages may be established by the CM for use by all subcontractors and their employees. Trash/debris generated during consumption, regardless of the location consumed at the project site, is to be deposited in dumpsters/trash receptacles by the Consuming Subcontractor and their employees prior to leaving this area. No radios will be allowed on site at any time.
48. Temporary lay-down area/Storage area will be located as directed by the CM. Space is limited and may be on a first come first served basis at the discretion of the CM. Any exterior containers, "conexes" trailers or other storage devices used onsite are the sole responsibility of the Subcontractor.
49. Delivery of materials for the Subcontractor is to be done by the Subcontractor having sufficient forces on site to offload at the time of delivery.
50. Subcontractors are required to do their own take-off for their scope of work and not rely on any quantities stated or shown on plans or the construction documents.
51. All spoils created by Subcontractor are to be disposed of Offsite at locations procured by the Subcontractor.
52. All Subcontractors are responsible for their own licenses that may be required by State, Local or Federal Jurisdictions before any work on this project may commence. Any and all costs for license(s) will be paid by the subcontractor.
53. All Subcontractors are responsible for procurement and purchasing any and all permits, tap fees, special inspections, other fees with-in their Bid Package required to complete their work per plans and specifications.
54. Storage of material inside of any building is prohibited unless approved by the CM.
55. If a Bid Package lists a Section Number and Description that indicates that the Entire Section is to be included complete.
56. If a Bid Package lists a Description Title or CSI Division number that indicates that the Entire work encompassing the description, title or division is to be included complete.
57. The Bid Packages, as compiled, including specification sections and verbiage are to be bid as a complete system, including all components for the complete system. When work is associated with a specific bid package but the associated specification section is not listed in the bid package it is the same as if the section was listed.
58. The Owner and CM reserves the right to reject any and all bids.



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59. The CM will only award agreements/contracts/PO's based on the lowest responsible qualified proposal, provided it is in the best interest of the Owner and/or CM.
- a. To determine the lowest responsible qualified proposal the CM will evaluate proposals based on at least the following considerations:
 - i. #1>>>**COMPLETED AND ACCEPTED SUBCONTRACTOR QUALIFICATION STATEMENT WITH CM. Request this document via email to estimating@resmithconst.com at minimum 10 working days prior to bid.
 - ii. Total amount of proposal including Base Bid and Alternate Bids
 - iii. Completed Bid Form
 - iv. Bidders bonding rate and capacity
 - v. Sufficiency of Bidders financial resources
 - vi. Evaluation of Bidders labor rates and available manpower, personnel and other resources.
 - vii. Bidders ability to perform in accordance with the Contract Documents
 - viii. Bidders history of performance working under the CM
 - ix. Bidders history of completing similar projects and scopes
 - x. Bidders Change Order History with the CM on similar projects and scopes
 - xi. Evaluation of Bidders Safety Record
 - xii. Bidders history of compliance with applicable laws, codes, rules, regulations
 - xiii. Past, Current or Pending litigation and the amounts and nature there-in
 - xiv. Submitted and Completed Subcontractor Qualification Form
60. A Post bid interview may be required of Subcontractors at the discretion of the CM. Those Subcontractors that the Post-Bid Interview is deemed required of will be contacted post-bid with specifics.
61. It is the responsibility of the Subcontractor to be aware of the project in its entirety including all other bid packages and the inclusions and exclusions there-in and what they shall include to provide a complete scope of work.
62. Time and Material (T&M) work directed by the CM.
- a. The CM reserves the right to initiate and direct work to be done by the Subcontractor on a Time and Material basis. When T&M work is directed by the CM to the sub, the sub shall:
 - i. Get written documentation from the CM that the work is approved to proceed. This will be in the form of an RE Smith Construction Work Order or an email from the RE Smith Project Manager.
 - ii. Keep time cards on each employee doing the work that breaks down the time the employee spent doing the work the work being performed and classification of the employee while doing the work (when a prevailing wage project).



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- iii. Keep detailed record and account of all equipment and material used and include invoices from suppliers where the equipment or material was used.
 - iv. Provide pictures of completed work that may not be visible to view.
 - v. Once completed the Sub will get written approval from the RE Smith Site Super or Project Manager that the work is complete and ready to be reviewed by the CM or Design Team or Owner in full.
 - vi. Once the T&M work is complete and approved the sub shall provide to the CM all above documents with a tabulation sheet matching that which is included in the Contract Modification Procedure specifications of this project.
63. Any discrepancies, questions or RFI's of any sort in Bid Packages, Plans, Specifications etc., are to be asked in written form either e-mail or mail to the attention of the CM per the Project Documents at minimum 96 hours before the time that bids are due.
64. By providing and signing the Bid Form you hold RE Smith Construction and it's employees harmless and agree to all terms as set forth on the Bid Form and in the plans and specifications of which this document is a part.

SEE FOLLOWING PAGES FOR BID PACKAGES



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Bid Package 03

Concrete

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Concrete** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Bidding & Contract Requirements

Division 01 – General Requirements

Appendix A

Division 03 – Concrete

- Section – 033000 Cast-In-Place Concrete

Division 05 – Metals

- As it applies to installation of anchor bolts and all other steel items installed/embedded in concrete supplied by others.

Division 07 – Thermal & Moisture Protection

- Section – 072100 Thermal Insulation
 - As it applies to below grade insulation at concrete foundations.
- Section – 079200 Joint Sealants
 - As it applies to caulking at control joints in SOG and sidewalks when/where detailed and/or specified in concrete applications.

Division 22 – Plumbing

- As it applies to coordination with and of plumbing sleeves, floor drains, piping, etc., provided and installed by BP 22 Plumbing Subcontractor that touches/affects this Bid Package.

Division 23 – HVAC

- As it applies to coordination with and of HVAC sleeves, pads, units, piping, etc., provided and installed by BP 23 HVAC Subcontractor that touches/affects this Bid Package.

Division 26 – Electrical



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- As it applies to coordination with and of electrical sleeves, pads, units conduit, piping, etc., provided and installed by BP 26 Electrical Subcontractor that touches/affects this Bid Package.

Division 31 – Earthwork

- Section – 312000 Earth Moving
 - As it applies to the scope of work in this bid package.
- Section – 313116 Termite Control

Division 32 – Exterior Improvements

- Cast-in-Place Concrete for Sitework
- Section - 321313 Concrete Paving
- Section – 321373 Concrete Paving Joint Sealants

Additional bid package requirements:

- Hoisting of all materials.
- Include the concrete wash-out pit in its entirety as required including routine maintenance per MO DNR and specifications.
- Include new curbing as shown.
- Layout of all building concrete items including but not limited to embedded in concrete and architectural and structural control and expansion joints in concrete applications. CM will provide 2 control points and 1 benchmark only.
- Moisture mitigation, Cold and hot weather requirements, including all admixtures, hot water /ice in concrete mixes and protection of concrete items to maintain the project schedule.
- All bracing as needed/required.
- Providing/installing all required reinforcing, including supports such as chairs and weldable couplers.
- Spoils removal will consist of transporting all spoils from this bid package to a location designated by the CM's project superintendent. BP 31 subcontractor will utilize the spoils that are suitable for site grading and will haul off site all spoils that are unsuitable.
- Include all required concrete pumping to complete this scope of work.
- Joint filling of all saw joints in all concrete slabs and concrete paving.
- Include the installation of all structural steel anchor bolts and all steel embedded items in concrete with the exception of bollards which are provided and installed



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- complete by the BP 08A subcontractor. BP 05 subcontractor or the CM will furnish all other steel embedded materials required except for bollards.
- Include all base rock under concrete slabs and paving and at wall backfill where shown. Only rock may be used as wall backfill unless approved in writing by the CM.
 - This Bid packages work will start at subgrade which is defined as below baserock at SOG and sidewalks.
 - Include backfilling of footings up to subgrade with compacted crushed stone/base rock at North footing line to allow precast crane to drive in and then once complete remove baserock to allow for precast panels to be set on clean footings.
 - Include splash blocks as required at Downspouts to grade.
 - Include backfilling of footings with compacted crushed stone/base.
 - Slab blockouts at recessed column locations.
 - Provide non-shrink grout for Steel Columns baseplates.
 - Include bituminous paint at steel columns below grade or finished floor concrete.
 - Include valley gutter complete with concrete and base.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 08

Storefronts/Glazing

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all Storefronts/Glazing as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 07 - Thermal and Moisture Protection

- Section 07 92 00 - Joint Sealants
 1. As it relates to filling joints/seams at all glass/glazing applications and abutting dissimilar materials. This bid package subcontractor will furnish and install backer rod/filler as required and joint sealant around the perimeter of all products/systems in this bid package at the interior and exterior of the item(s) at minimum and will include four lines of caulking at all storefront frame perimeters. Install 1 line each at interior and exterior when frame/door/window/item is installed into substrate/opening and then once finish materials are installed provide 1 line each again against finished material 1 interior and 1 exterior. On interior openings 4 lines are still required. If joint sealants are shown on details of the project at items within this scope of work above that called out in this section then the more prevalent shown shall be completed.

Division 08 - Openings

- Section 08 06 71 Door Hardware Schedule
 - As related to ALuminum Door Units only
- Section 08 11 13 - Hollow Metal Door and Frames
 - As required for coordination of glazing in HM door units.
- Section 08 14 16 Wood Doors
 - As required for coordination of glazing in Wood door units.



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- Section 08 43 13 - Aluminum-Framed Storefronts
- Section 08 80 00 - Glazing
- Section 08 71 00 - Door Hardware (as related to hardware for Aluminum Storefronts)
- Section 08 87 19 - Security Glazing Film

Additional bid package requirements:

1. This bid package will furnish, install, and remove temporary plywood closures at all framed openings within this bid package that glass has not yet been installed.
2. It is the responsibility of this bid package to make all installations water-tight.
3. Furnish and Install all hardware required for Aluminum Door units. Cylinders will be provided by others but installed in this Bid Package.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 08A

General Trades

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **General Trades** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 02 - Existing Conditions

- Section 02 41 00 Demolition - As related to specific Building Demolition items not in Bid Package 31 Subcontractor scope of work. Specifically includes temporary partitions required and protection of existing elements such as Walls and floors that remain.

Division 03 - Concrete

- Section 03 35 11 Concrete Floor Finishes

Division 04 - Masonry

- Section 04 01 00 Maintenance of Masonry
- Section 04 05 11 Masonry Mortaring and Grouting

Division 05 - Metals

- Section 05 50 00 Metal Fabrications
- Section 05 52 13 Pipe and Tube Handrailing

Division 06 – Wood, Plastics and Composites

- Section 06 20 00 Finish Carpentry
- Section 06 41 00 Architectural Wood Casework

Division 07 – Thermal and Moisture Protection

- Section 07 14 00 Fluid Applied Waterproofing
- Section 07 62 00 Sheet Metal Flashings & Trim
- Section 07 71 00 Roof Specialties
- Section 07 72 00 Roof Accessories
- Section 07 92 00 Joint Sealants (Only as required at Roofing Applications)
- Section 07 95 13 - Expansion Joint Assemblies (Exterior Only)



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Division 08 – Openings

- Section 08 06 71 Door Hardware Schedule (as related to Hollow Metal & Wood Doors & Frames)
- Section 08 11 13 Hollow Metal Doors and Frames
- Section 08 14 16 Flush Wood Doors
- Section 08 31 00 Access Doors and Panels (ONLY as shown on Architectural drawings and not those which are shown on MEP plans or those required by MEP Bid Packages).
- Section 08 33 23 Overhead Coiling Doors
- Section 08 71 00 Door Hardware (as related to Hollow Metal & Wood Doors & Frames)

Division 10 – Specialties

- Section 10 14 00 Signage
- Section 10 21 13.19 Plastic Toilet Compartments
- Section 10 26 00 Wall and Door Protection
- Section 10 28 00 Toilet, Bath & Laundry Accessories
- Section 10 44 00 Fire Protection Specialties
- Section 10 75 00 Flagpoles

Division 11 – Equipment

- Section 11 13 13 Loading Dock Bumpers

Division 12 - Furnishings

- Section 12 24 00 Window Shades
- Section 12 36 00 Countertops

Division 13 - Special Construction

- Section 13 34 19 Metal Building Systems

Division 31 - Earthwork

- Segmental Retaining Wall Complete including backfill and fabric as required by detail.

Division 32 - Exterior Improvements

- Parking Lot Striping

Additional bid package requirements:

1. Bid package will include furnishing and installation of all sections and items unless otherwise indicated.
2. Provide and install complete 8 each 6” steel bollards 96” tall at the transformer location including concrete.



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3. Include grouting of all Hollow Metal frames as required by plans and specs.
4. Bid package will include, FINAL CLEANING per specifications but not be limited to cleaning of interior and exterior of glass, doors, frames/windows, walls, floors, etc.
5. Includes the purchasing, installation and removal of the project sign(s). Refer to the plans and specifications. Include minimum 2-each 4'x8' alumapanel board style one piece sign mounted on treated plywood backing with 4"x4" and 2"x4" treated wood framing. Ground mount either; posts in concrete or wood framed ground mount base. Jpeg file (or similar) to be provided by Architect for sign graphics.
6. Bid package will include the installation, periodic maintenance as required and removal of a 6'-0" tall chain link panel temporary fence. Include an allowance of \$4,000.00 for extra fence at future lay-down areas.
7. Bid package will include furnishing and installation of all millwork, solid surface including integral sinks in bathroom vanities if shown.
8. Install Owner Furnished Contractor Installed Toilet Accessories.
9. Hoisting of all materials.
10. Furnish And Install all concealed countertop brackets.
11. Include complete any and all 2x bases for all Millwork as required.
12. Include Whiteboards/Visual Display Units. Basis of Design Claridge or similar.
13. Install Owner Furnished Mezzanine chain, Toilet accessories and TV's and TV mounting brackets.
14. Furnish and Install Outdoor Plaque Stands (Detail S2-2). Plaques furnished and installed by Owner.
15. Furnish and Install wheel stops, bike racks and Handicap Parking Signs.
16. Provide handraking/finish grading of all topsoil machine graded by others. Furnish & Install mulch as shown and hydroseed disturbed areas as required.
17. Include \$10,000.00 allowance for furnish and install of new fence.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive, and will not be accepted.



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Bid Package 09

Metal Studs/Gyp Board/Ceilings

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all Metal Studs/Gyp Board/Ceilings as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 05 - Metals

- 05 40 00 - Cold-Formed Metal Framing

Division 06 – Wood, Plastics and Composites

- Section 06 10 00 Rough Carpentry
- Section 061010 Non-Structural Rough Carpentry
- Section 06 15 00 Wood Decking
- Section 06 83 16 Fiberglass Reinforced Paneling

Division 07 – Thermal & Moisture Protection

- Section 07 21 00 Thermal Insulation
 - As it relates to insulation requirements of metal stud and/or wood framed walls, ceilings, and roof spaces not installed in the cavities of the Metal Building.
- Section 07 25 00 Weather Barriers
- Section 079 20 00 Joint Sealants
 - As it relates to filling joints/seams at gypsum board applications and abutting dis-similar materials.
- Section 07 84 00 Firestopping
 - As related to the work of this Bid Package
- Section 07 95 13 Expansion Joint Cover Assemblies
 - As it relates to expansion control requirements, expansion joints in and abutting gypsum board applications per plans, specs and/or manufacturers requirements.

Division 09 – Finishes



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- Section 09 21 16 Gypsum Board Assemblies
- Section 09 51 00 Acoustical Ceilings
- Section 09 84 30 Sound-Absorbing Wall & Ceiling Units

Additional bid package requirements:

1. Hoisting of all materials.
2. Provide all in-wall blocking requirements for all bid packages.
3. Include Painted/Vinyl Stencil of Fire Walls/Smoke Walls as required on sheetrock.
4. Installation, maintenance and removal as directed by CM of floor protection during the tape and finishing process. Also include floor scraping, sanding by hand and/or machine to remove excess joint compound from floors, walls and adjacent surfaces as required for the other Bid Package Subcontractors to perform their work (Example: joint compound removal from slab-on-grade/decking prior to flooring sub starting assessing the floor).
5. All electrical boxes will be either covered or cleaned out of excess drywall compound prior to the painter starting work. All electrical boxes that are not cut tight to the drywall shall be patched prior to the painter starting work. Gaps between the electrical box that are visible after the wall plate is installed shall be patched and if the wall has already been painted, back charges will be issued for repainting.
6. Bid package to provide and install open cell spray foam insulation at all cavities in exterior envelopes too small to fill with BATT insulation.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 09A

Flooring

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Flooring** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 07 – Thermal & Moisture Protection

- Section 079200 Joint Sealants
 - As it relates to filling joints/seams at flooring applications and where this Bid Packages work abuts dis-similar materials to make a clean and complete flooring system.
- Expansion Control
 - As it relates to expansion control joints in flooring applications per manufacturer's recommendations.

Division 09 – Finishes

- Section 09 30 00 Tiling
- Section 09 65 00 Resilient Flooring (& Base)
- Section 09 68 13 Tile Carpeting

Additional bid package requirements:

1. Layout of all flooring and related items including expansion joints in floor applications.
2. Include a \$3,000.00 allowance for additional floor prep and floating.
3. Includes waxing/sealing of floor products as per the specifications and/or manufacturer's instructions.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 09B

Painting

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Painting** as required per the contract documents, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 05 – Metals

- Section 05 50 00 Structural Steel Framing
 - As it relates to prepping, bondo-izing, priming and painting exposed to view steel products and handrails and concealed items when required. Material and labor to be included under this bid package.

Division 07 – Thermal & Moisture Protection

- Section 07 92 00 Joint Sealants
 - As it relates to filling joints/seams in painted walls, floors and ceiling applications and at all dis-similar materials with-in painted areas.

Division 09 – Finishes

- Section 09 91 13 Exterior Painting
- Section 09 91 23 Interior Painting

Division 13 - Special Construction

- Section 13 34 19 Metal Building Systems - as related to Painting as specified and shown.

Additional bid package requirements:

1. Includes the protection of all flooring, walls, doors, frames, fixtures and devices, etc., that are installed in place during the painting process.
2. Includes, but not limited to, the caulking of interior door frames, and the interior joint between windows and drywall.
3. Include a \$ 4,000.00 T&M allowance for unforeseen nicks, gouges, divets etc..

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 12

SEATING

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Seating** as required per the contract documents, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 12 – Furnishings

- Section 12 61 00 Fixed Audience Seating
- Section 12 66 13 Telescopic Bleachers

Additional bid package requirements:

1. Includes the protection of seating and all existing and newly installed works including flooring, walls, doors, frames, fixtures and devices, etc., that are installed in place during the installation process.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 21

Fire Sprinkler

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Fire Sprinkler** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Bidding & Contract Requirements

Division 01 – General Requirements

Appendix A

Division 07 – Thermal & Moisture Protection

- Section 07 92 00 Joint Sealants
 - As it relates to caulking of fixtures with-in this bid package.
- Section 07 84 00 Firestopping
 - As it relates to this Bid Package work

Division 21 – Fire Sprinkler System COMPLETE

Division 22 Plumbing, 23 HVAC, 26 Electrical - As required for coordination

Additional bid package requirements:

1. This bid package will include all related fire suppression items from 1'-0" above finish floor at the fire line.
2. Include all required permits, tap fees, inspection fees and impact fees.
3. Includes the engineered stamped design of the fire suppression system.
4. Include requirements of the AHJ all relevant Building Codes and all submittals to and approval from the AHJ.
5. Include the fire pump complete and all required access panels as needed as they relate to the fire suppression/sprinkler system.

No exclusions to a bid package will be allowed. If any exclusions are listed on the bid form, the bid will be identified as non-responsive.



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Bid Package 22

Plumbing

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Plumbing** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 03 – Concrete

- Section 03 30 00 Cast-in-Place Concrete
 - As it relates to required thrust blocks or concrete at or behind plumbing piping, cleanouts or materials.

Division 07 – Thermal & Moisture Protection

- Section 07 92 00 Joint Sealants
 - As it relates to caulking of fixtures with-in this bid package.
- Section 07 84 00 Firestopping
 - As it relates to this Bid Package work

Division 22 – Plumbing COMPLETE

Division 21 Fire Suppression, 23 HVAC, 26 Electrical – As required for coordination

Division 31 – Earthwork

- Section 31 20 00 Earth Moving (Excavation & Fill)
 - As required for this bid package
- DSection 31 23 19 Dewatering
 - As required for this bid package

Division 33 – Site Utilities

- Gas Line work as required both interior and exterior.

Additional bid package requirements:

1. Include all required permits, tap fees and impact fees.



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2. Offsite removal of related spoils shall be included in this bid package.
3. Include all requirements of providing all penetrations, blockouts, etc. for tying into existing and new structure components/items/piping/work required.
4. Include all work complete for the grease interceptor. This work to stop and be picked up by the BP 31 Subcontractor as shown on P sheets and as called out as refer to civil plans for continuation.
5. Include temporary water installation as directed by CM.
6. Include all required access panels as needed to access any and all plumbing items that require review, maintenance, adjustment, etc. as they relate to Plumbing whether shown or not.
7. Provide protective cages for plumbing items as required.
8. Furnish and install sleeves of sufficient size for new underground piping to pass through where required through/under new concrete as required for plumbing items.
9. Include all trenching, backfilling, compaction as required for all related below grade plumbing operations complete.
 - a. When plumbing lines install under rock, concrete or asphalt it shall be backfilled with rock compacted.
 - b. When plumbing lines install under dirt/landscaping it shall be backfilled with dirt and compacted.
10. Include all work required for site gas line as required that which is not taken care of by the local Gas Utility Company.
11. Furnish and Install Mop and Broom holder at all Mop Sinks Bobrick Model B-223 or equal OR as specified.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 23

HVAC

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all HVAC as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 07 – Thermal & Moisture Protection

- Section 079200 Joint Sealants
 - As it relates to the HVAC system and the installed finished products in their permanent location.
- Section 07 84 00 Firestopping
 - As it relates to the requirements of the HVAC system through floors, walls, ceilings etc.

Division 23 HVAC COMPLETE

Division 21 Fire Suppression, 22 Plumbing, Division 26 Electrical

- As it relates to coordination and other HVAC requirements
- As it relates to thermostats and control wiring provided by BP 23 HVAC Subcontractor. BP 26 Electrical Subcontractor to provide all conduit for BP 23 HVAC Subcontractor to install and connect thermostats.

Additional bid package requirements:

1. Temporary HVAC and Humidity Control: BP 23 Subcontractor shall Include the relocation complete for the existing RTU and all components necessary to be reused or provide new as needed. Include an allowance of \$35,000.00 in the Base Bid to cover ALL of the work (labor, equipment, materials complete) that provides



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- temporary heating, cooling and humidity control required by construction activities for curing or drying of completed installations and for maintaining and protecting installed construction from adverse effects of low/high temperatures or irregular humidity. This allowance will be used on a T&M basis (see Section 00 20 00 Common Requirements for more information on T&M). Allowance will be used as directed by CM on a T&M basis and any unused portion will be deleted from this subcontractor's contract prior to final completion of the project. Select equipment that will provide for installed specified items that will not have a harmful effect on completed installations or elements being installed.
- a. 1. Maintain a minimum temperature of 65 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.
 - b. 2. Use of facility environmental systems prior to substantial completion: The contractor MAY NOT utilize permanent facility HVAC systems for temporary construction.
 - c. If the above allowance amount is determined by the BP 23 subcontractor to be inadequate, they shall notify the CM prior to bidding. If the BP 23 subcontractor does not notify the CM prior to bidding then they shall include any and all additional costs above the allowance to cover what they feel is adequate for this size and type of project. No extra monies will be paid for any work done by this Subcontractor to maintain the temporary HVAC and Humidity Control on this project.
2. All radiant, hydronic and condensate piping is to be included in this bid package complete.
 3. Include all required access panels as needed to access any and all HVAC items that require review, maintenance, adjustment, etc. as they relate to HVAC whether shown or not.
 4. Include all trenching, backfilling, compaction as required for all related below grade HVAC operations complete if required.
 5. Furnish and install sleeves, sleeve seals and/or blockouts of sufficient size for new underground piping to pass through where/when required through/under new concrete AND Furnish and install sleeves, sleeve seals and/or block outs of sufficient size for new HVAC work to pass through where/when required through Walls, Ceilings, Roofs etc. where required for HVAC items. Coordinate with the CM and other subcontractors on requirements.



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6. Supply equipment curbs and coordinate installation with BP 13, and BP 09 Subcontractors.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 26

Electrical

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Electrical** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 02 - Existing Conditions

- Demolition
 - As related to all electrical demo required

Division 07 – Thermal & Moisture Protection

- Section 07 84 00 Firestopping
 - As it relates to the requirements of this Bid Package through walls, ceilings, floors etc.
- Section 07 92 00 Joint Sealants
 - As it relates to the requirements of this Bid Package.

Division 21 Fire Suppression, 22 Plumbing, 23 HVAC

- As it relates to coordination in general and specific with other trades.
- As it relates to Electrical powering/hooking-up of Mechanical items/systems.
- As it relates to thermostats and control wiring provided by BP 23 HVAC Subcontractor. BP 26 Electrical Subcontractor to provide all conduit for BP 23 HVAC Subcontractor to provide, install and connect thermostats and thermostat cabling/wiring.

Division 26 – Electrical COMPLETE

Division 27 - Communications and Security COMPLETE

Division 31 – Earthwork

- Excavation & Fill
 - As required for Electrical Work and Electrical Utilities



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- Dewatering
 - As required for Electrical Work and Electrical Utilities

Division 33 - Utilities

- Utility Identification and Site Demo (as it relates to Electrical)

Additional bid package requirements:

1. Coordinate with Owner, CM, BP 08A as required on the Access Control System.
2. Include all required site electrical demo, permits, tap fees and impact fees.
3. Provide and maintain temporary power as explained:
 - a. At the jobsite trailer locations (maximum 3) hook-up trailer to temporary power.
 - b. At the start of footings one each Service location at each building with a minimum of six (6) 20 amp GFCI duplex receptacles will be required.
 - c. After footings and as the building becomes accessible, service is to be expanded so that power is accessible to any location with-in 100' any way.
 - d. HVAC and dehumidification process and equipment.
4. Provide and maintain interior temporary lighting as required by provisions of OSHA CFR 1926 Subpart D standard number 1926.53 (Table D-3) and/or the specifications (Pre-Installation Conference with CM required). Excluded are Exterior Work applications that include but are not limited to, concrete work, brick work, EIFS work, metal panel work, roofing and sheet metal work, Storefront/Curtainwall/Glazing work, etc.
5. Include an allowance of \$10,000.00 for electrical work not called for in plans and specs. Allowance will be used as directed by CM on a T&M basis and any unused portion will be deleted from this subcontractor's contract prior to final completion of the project.
6. This Bid package shall include conduit for all trades/bid packages as specified/shown/required.
7. Includes all required underground work for electrical, data and communications.
8. Offsite removal of all related spoils shall be included in this Bid Package.
9. Install all required access panels as they relate to Electrical whether shown or not but as required to view, adjust, maintain, etc. any electrical items exposed from view.
10. Furnish and install sleeves, sleeve seals and/or blockouts of sufficient size for new conduit to pass through where required through/under new concrete, walls, ceilings, roofs, etc., where required for electrical items.



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11. Include all trenching, backfilling, compaction as required for all below grade electrical work complete.
 - a. When electric lines install under rock, concrete or asphalt it shall be backfilled with rock compacted.
 - b. When electric lines install under dirt/landscaping it shall be backfilled with dirt and compacted.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 31

Site Work/Site Demolition/Site Utilities

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Site Work/Site Demolition/Site Utilities** as required per the contract documents, common requirements, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 02 – Existing Conditions

- Section 02 41 00 Demolition

Division 03 – Concrete

- Section 03 30 00 CIP Concrete
 - As required for providing/coordinates subgrade for all concrete work and coordination with this section

Division 31 – Earthwork

- Section 31 10 00 Site Clearing - SITE DEMO
- Section 31 20 00 Earth Moving
- Section 31 23 19 Dewatering (as related to work of this Bid Package)
- Erosion and Sedimentation Control

Division 32 – Exterior Improvements

- Section 32 12 12 Asphaltic Paving
 - As related to providing subgrade at all asphalt areas on site.
- Section 32 13 13 Concrete Paving
 - As related to providing subgrade at all concrete on site.

Division 33 – Utilities

- Utility Identification
- Section 33 11 00 Water Utility Distribution
- Sewer Utility Piping & Structures



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- Section 33 41 00 Utility Drainage Piping
- Section 33 41 10 Subdrainage

Additional bid package requirements:

1. This package includes removal of any and all buried lines within the existing building footprint to a distance of 10' beyond the foundations.
2. This package includes leaving foundation and buried line excavations open for fill by work of site contractor.
3. This package includes any and all requirements for environmental laws, pollution control, street clean up during this process, permits, traffic control and flagmen, barricades as required.
4. This package includes shutting off and capping at the road/property line any existing utility services found on site that serves the existing facility, including, but not limited to, phone, fiber, cable, electric, gas, water, sewer, storm drainage. This includes coordination with any utility companies and owner as required. Owner will notify utility companies of the shut downs.
5. This package includes any bracing and or shoring of existing structure during the demolition process. Any coverings of existing overhead power lines will need to be requested and coordinated by this contractor with utility company.
6. This package includes that all excavations and/or foundation removal be left benched per OSHA standards. Include safety fence setback a minimum of 2' around entire perimeter of excavation/demolition.
7. Work of this package will follow the project schedule and be complete by the dates shown.
8. The Fire Line shall be installed to a point 1'-0" above finished floor including the flange as part of this bid package.
9. Includes all demolition, saw-cutting as required, capping of demolished utility lines and removal of all required concrete, storm piping, utility piping, trees, asphalt etc. identified by the contract documents.
10. Include the Construction entrance and all components required to complete, include maintenance and removal as required and as directed by CM.
11. Ensure remaining/existing trees are protected per plans and specifications.
12. Include all rip rap complete.
13. All underground piping 5'-0" outside the building, including but not limited to water lines/mains, sanitary sewer lines/mains and fire lines/mains, perimeter drain, foundation drains, etc.. Including proper trenching and backfilling of these lines.



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- Coordinate with BP 22 on the proper location of tie-in to building utility lines within their scope.
14. Includes the backfilling of all concrete walls, curb and gutter, other site concrete items and walks with suitable specified materials. Backfill of concrete footings as required will be in Bid Package 03 Concrete.
 15. Include stripping and stockpiling of existing site topsoil and then furnishing, placing and machine grading of all required topsoil for the project. Include import of topsoil if required to provide specified depths and types.
 16. Offsite removal of all spoils created by work of this Bid Package and spoils of other Bid Packages.
 17. Includes the reporting, furnishing, installation, maintenance and removal of all erosion control requirements (SWPPP), including install and removal of construction entrance, filing and payment of DNR permit.
 18. Include foundation drain and downspout adapters at the building downspout to UG piping.
 19. Include all required permits, tap fees and impact fees.
 20. This subcontractor will be required as directed by CM to do “re-grading touch-up” periodically which will entail smoothing of ruts made by others equipment, light vehicle travel, other miscellaneous disturbance of subgrade soil and minor regrading as needed. Re-grading touch-up may involve the entire site or be localized areas. Include 4 mobilizations/demobilizations to do regrading touch-up.
 21. **Complete** Site subgrade is to be achieved per schedule and prior to initial de-mobilization by this Subcontractor with emphasis being put on the completion of the building pad.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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Bid Package 32

Asphalt Paving

Provide all material, labor, equipment, tools, supervision and other items necessary to complete all **Asphalt Paving** as required per the contract documents, bidding documents, this Scope of Work, and other items as issued by Addenda. Contract specifically includes, but is not limited to, the following:

Division 00 – Procurement and Contracting Requirements

Division 01 – General Requirements

Appendix A

Division 31 - Earthwork

- Section 31 20 00 Earth Moving
 - As required for baserock under asphaltic paving and curb and gutter

Division 32 – Exterior Improvements

- Section 32 12 16 Asphalt Paving

Additional bid package requirements:

1. This bid package include furnish and install per AHJ and project documents of all crushed stone under all asphalt paving and concrete curb and gutter installed on subgrade.
2. Include 2 mobilization fees. First mobilization shall be after site grading operations and shall include installation of the first 5” (inches) of Type 5 Aggregate Base under all asphalt areas. Second mobilization shall be later (as dictated by Project schedule) and shall include the completion of the Base and Asphaltic base and surface to complete the Asphalt paving in its entirety.
3. Include the cost to survey the asphalt areas prior to mobilization two to confirm the existing elevation of mobilization one baserock installed. INCLUDE 2.5” extra Type 5 Aggregate base to bring existing base elevations back to subgrade. Provide a report to the CM detailing existing versus required aggregate amounts. Any unused aggregate will be credited back to the CM at the cost as shown on the Unit Price Sheet of the Bid Form. USE UNIT PRICE No. 3 to provide the unit price cost.

No exclusions to a bid package will be allowed. If any exclusions are listed on a bid form, the bid will be identified as non-responsive.



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END OF SECTION 00 20 00



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SECTION 00 21 13 – INSTRUCTIONS TO BIDDERS

1. THE WORK

The Project is construction of a new Performing Arts Center for the Cassville School District located on the South side of the High School located at 1825 State Hwy Y, Cassville, MO 65625. The project consists of Site Demo, Site Grading, Site Utilities, Asphalt Paving, Concrete, Structural Steel, Metal Stud Framing, Rough Carpentry, Doors, Windows, Hardware, Overhead Doors, Gypsum Board, ACT Ceiling, Flooring, Painting, Specialties, Auditorium Seating, Pre-Engineered Metal Building with Standing Seam Roof and Metal Wall Panels, Fire Sprinkler, Plumbing, HVAC, and Electrical.

2. SECURING PROJECT DOCUMENTS

All Bidders are hereby directed to:

**Engineering Reprographics, Springfield, MO (417-869-2222)

**R.E. Smith Construction; www.resmithconst.com (417-623-4545)

**Hard Copies of plans and specifications and other related contract information may be obtained at the bidders own expense through any of the above ** marked locations, or as the bidder so chooses.

Any questions related to obtaining bidding or bid documents are to be directed to the CM:

RE Smith Construction Company

Attn: Clint Walton

1036 W. 2nd Street

Joplin, MO 64801

(417) 623 4545

estimating@resmithconst.com

3. INTERPRETATION OF CONTRACT DOCUMENTS

- A. If any person contemplating submitting a bid for construction of the Work is in doubt as to the true meaning of any part of the proposed Contract Documents, or finds discrepancies in, or omissions from any part of the proposed Contract Documents, he shall submit to the CM a request for interpretation thereof not later than five (5) days before bids will be opened. The person submitting the request shall be responsible for its prompt delivery.
- B. Interpretation or correction of proposed Contract Documents will be made only by



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Addendum. Distribution of Addenda will be via electronic distribution from the CM. Neither the Owner nor Architect will be responsible for any other explanations or interpretations of the proposed Contract Documents other than that via Addenda. Bidders shall not assume that a discrepancy or conflict thereby voids or omits any item entirely from the contract.

- C. Discrepancies, conflicts, ambiguities, and errors, or issues which may have more than one interpretation, should initially be submitted to the CM who will forward the issue to the Architect who will make the interpretation. In absence of an interpretation issued by addendum, the default position shall be for the bidder to bid the more restrictive and/or more costly interpretation which gives the owner the option of either. Items in the drawings that are not specifically called out in the drawings but can be reasonably inferred to be a part of the project will be considered a part of the Work.

4. SUBSTITUTIONS

- A. Specific materials and manufactures for all disciplines have been specifically selected to meet requirements and substitutions will meet all requirements to be considered acceptable. Substitution requests provided to the CM filled out entirely on CSI Form 13.1A will be reviewed on these bases and any products not approved in the bidding process as described herein will not be accepted during the execution of the Work and it will be the responsibility of the Subcontractor requesting substitution to provide the specified or approved product. Substitution requests that are not approved by addenda during the bidding process are considered rejected.

5. ADDENDA

- A. Addenda will be released by the CM to be distributed to ALL LOCATIONS DESCRIBED ABOVE at the close of business on Fridays during the bidding process. The Official Plan Room will be www.resmithconst.com Plan Room. Revisions, clarifications, interpretations, and substitution request approvals will be contained in the addenda.

6. EXAMINATION OF DOCUMENTS AND SITE OF WORK

- A. Before submitting a bid, each bidder shall examine the Drawings carefully, shall read the Specifications and all other proposed Contract Documents, and shall visit the site of the Work. Each bidder shall fully inform himself prior to bidding as to the existing conditions and limitations under which the Work is to be performed. Bidders shall review all



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documents made available to him by the owner, and shall include in his bid a sum to cover the cost of items necessary to perform the Work to a completed and operational condition and as set forth in the proposed Contract Documents. No allowance will be made to a bidder because of lack of such examination or knowledge that is determined by the architect that could have been reasonably inferred by inspection. The submission of a bid will be considered as conclusive evidence that the bidder has made such examination.

7. PREPARATION OF BIDS

- A. In order to receive consideration, make bids in accordance with the following:
- B. Make bids upon the form provided (Section 00 41 00 Bid Form), properly signed and with all items filled out. Do not change the wording of the bid form, and do not add words to the bid form. Unauthorized conditions, limitations, or provisions attached to the bid may be cause for rejection of the bid. If alterations by erasure or interlineations are made for any reason, explain over such erasure or interlineations with a signed statement from the bidder. See section 00 11 13 Advertisement for Bids and section 00 19 00 Submission of Bids for information on bid delivery date and methods.
- C. Hand Delivered and Mailed Bids
 - a. Bids must include completed bid form Section 00 41 00. No bids received after the time fixed for receiving them will be considered. Late bids will be discarded.
- D. Optional Bidding Method
 - a. Electronic Mail (e-mail) and facsimile bids **will NOT be allowed**.
 - b. Telephone bids **will NOT be accepted**.
- E. Address bids to and deliver to the address as given, on or before the day and hour set for receiving the bids. Enclose mailed and hand delivered bid in a sealed envelope bearing the information as set forth in the Submission of Bids Section 00 19 00. Submit only the signed copy of the bid. It is the sole responsibility of the bidder to see that the bid is prepared and received properly and on time.
- F. All proposals must be properly signed and submitted as set forth in the Instructions to Bidders. Each Bidder shall specify in his proposal, in figures, the lump sum price or the unit price for each of the separate items listed in the proposal. The proposal shall not contain interlineations, alterations, or erasures except as noted in Paragraph below. The



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Bidder shall show the products of the respective unit prices and quantities in the amount column provided for that purpose. These extensions shall be totaled and in case of errors or discrepancies in extensions, the unit prices shall govern. All entries on the proposal form shall be in ink or typed. All errors in extensions or totals will be corrected by the CM and such corrected extensions and totals will be used in comparing bids.

- G. A Bidder may alter or correct a unit price, lump sum bid, or extension entered on the proposal form by crossing out the figure with ink and entering a new unit price, lump sum bid, or extension above or below in ink, and initialing the alteration or correction. If an alteration or correction of a unit price or lump sum bid is **not** initialed, the original unit price or lump sum bid will be assumed to be correct. All corrections must be made before any bids have been opened.
- H. No Bidder shall stipulate in his proposal any conditions not contained in the specifications or standard proposal form contained in the contract documents.
- I. Bids are to be presented by the method(s) allowed, on the bid date and at the bid time delivered to the place specified in the Advertisement for Bids or announced under separate cover. Bidders shall be responsible for actual delivery of proposals during business hours, and it shall not be sufficient to show that a proposal was dispatched in time to be received before scheduled closing time for receipt of bid.

8. SUBMISSION OF BIDS

- A. Bids shall be delivered to the CM, R.E. Smith Construction Company, in accordance with Section 00 19 00 and other relevant sections.
- B. Bidders are allowed to bid Multiple Bid Packages; **each bid package is to be sent independent of the other bid package**. For example, if Subcontractor A wishes to bid, Bid Package 04 and Bid Package 05 they would submit one Bid for Bid package 04 and a separate Bid for Bid Package 05. Bids that are received with more than one bid package identified will be rejected.

9. WITHDRAWAL OF BIDS

- A. A bidder may withdraw his bid, either personally or by written request, at any time prior to the scheduled time for reading bids.
- B. No bidder may withdraw his bid for a period of **Thirty calendar days** after the date set for opening thereof, and bids shall be subject to acceptance by the Owner during this



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period.

7. **AWARD OR REJECTION OF BIDS**

- A. General: The Subcontract, if awarded, will be awarded to the **lowest and best responsible qualified bidder** complying with the terms set forth in the contract documents, in the best interest of the Owner and CM, subject to the CM and Owner's right to reject any or all bids and to waive informality and irregularity in the bids and in the bidding. The Contract Sum may be determined by the sum of the base bid, and/or the sum of any or all bid alternates, **in any order**, which the Owner may choose to add or delete from the base bid.
- B. Conditions of Award: Award of Contract will be based on the following factors in combination and in no particular order:
1. **PROPOSED CONTRACT AMOUNT:** Award will be based upon the best value of sum of base bid and any or all bid alternates the Owner may wish to accept. The Owner may accept Bid Alternates in any order and combination.
 2. **BIDDERS QUALIFICATIONS:** Award of Contract will be made to a bidder who is experienced and qualified in similar size and types of projects, with a history of successful projects completed on time and with supportive references. The goal of this section is to maximize likelihood of project success and minimize risk to the owner and CM:
 3. **BEST BID EVALUATION:** includes a subjective evaluation, by the CM provided to the Owner for approval, based on best qualified bid and:
 1. Compliance with bid requirements.
 2. Financial history and ability to remain financially strong during the construction and warranty period.
 3. A bidder who is unable to demonstrate ability, and/or history to schedule, manage, and complete the project through cooperative, systematic process, according to the Contract, may be disqualified and have their bid rejected.
 4. Performance history of the Subcontractor with Owner and the CM.

*See Section 00 20 00 Scopes of Work – for Further items related to Evaluation of Subcontractor bids

10. EXECUTION OF AGREEMENT

- A. The form of agreement between the CM and subcontractor shall be the Contractor's/CM's form. No erasures, modifications, changes etc. to this document will



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be allowed. If the Subcontractor marks-up or attempts to make changes to the agreement the CM will charge \$500/hour for review and consideration of the changes. An emailed Notice TO Proceed may be used as notice of award and the Subcontractor agrees that if given a Notice TO Proceed, they will start work immediately, the same as if they had an executed contract.

- B. The Subcontractors to whom Contracts are awarded shall, within seven calendar days after notice of award and receipt of Agreement forms from the CM, sign and deliver required copies to the CM. The date of the Agreement signed by the CM and Owner starts the clock on the Construction Time. However, the date of Substantial Completion and Final Completion is fixed by the Project Schedule. Submittal Data is to be submitted no later than that date as set forth by the CM.
- C. At or prior to delivery of the signed Agreement, the bidder to whom the Subcontract is awarded shall submit to the CM those Certificates of Insurance required by the Contract Documents and as are required by the Owner.
- D. Certificates of Insurance shall be approved by the CM and the Owner before the successful bidder may proceed with the Work. Failure to provide Certificates of Insurance in a form satisfactory to the CM and Owner shall subject the successful bidder to loss of time from the allowable construction period equal to the time of delay in furnishing the required material. Refusal of successful bidder to provide certificates of insurance that is satisfactory to the CM and Owner shall be cause for disqualification of this bid.

11. CONSTRUCTION TIME AND DAMAGES

The CM requires each sub-contractor to coordinate **all work** and cooperate with the CM and Owner regarding partial occupancy for purposes of installing furniture and equipment, and prepping of spaces for full occupancy.

- A. Commencement: It is expected that Subcontracts or a Notice to Proceed will be awarded within (5) days of bid open opening, but no later than (30) thirty days, and that the Work shall commence immediately after the Notice to Proceed.
- B. Real damages, Delay damages and Liquidated damages will be in effect for this project.
- C. Weather Days: The Subcontractor agrees to comply consistently with the Project Schedule provided by the CM. Schedule compliance is a condition of the bid. The Bidder



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agrees the days to complete the project includes allowance for inclement weather. No extension to the schedule will be allowed due to weather or labor relations issues unless the owner and architect determine they are extreme exceptions to common industry tolerances. Determining Common Industry Tolerance is a subjective judgment made by the Architect with documentation provided from the CM.

12. MATERIALS AVAILABILITY

- A. Prior to bidding, the Subcontractor shall confirm with their subcontractors and material suppliers that all materials, suppliers and subcontractors, which may impact the critical path of the Construction Schedule (See Section 00 20 00), are able to be delivered and/or provided such that the project schedule and substantial completion date are not adversely affected. The subcontractor shall immediately notify the CM and the CM will notify the Architect and/or Owner of any such conflicts and adversities, prior to issuance of final addendum, prior to bidding.

- B. The Subcontractor bears sole and full responsibility for compliance with terms of the contract for time and completion, (except as such terms may be modified by contract modification procedures upon timely notification by the Subcontractor.)

END OF SECTION 00 21 13



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SECTION 00 25 13 - PRE-BID MEETING

1.1 PRE-BID MEETING

- 1. A pre-bid meeting will be held on June 29, 2023 (06/29/2023) at 10:30 AM at the Project Site which is located at the existing Cassville High School at 1825 State Hwy Y, Cassville, MO 65625. All persons wishing to attend shall meet at the Lobby of the High School.**

- A. Attendance:
 1. Subcontractors: Attendance at Pre-bid meeting is recommended and will be used for post-bid qualifications. See Section 00 11 13.

- B. Agenda: Pre-bid meeting agenda will include review of topics that may affect proper preparation and submittal of bids, including the following:
 1. Procurement and Contracting Requirements:
 - a. Advertisement for Bids.
 - b. Instructions to Bidders.
 - c. Bid Form and Attachments.
 - d. Bid Submittal Requirements.
 2. Communication during Bidding Period:
 - a. Obtaining documents.
 - b. Bidder's Requests for Information.
 - c. Bidder's Substitution Request/Prior Approval Request.
 - d. Addenda.
 3. Contracting Requirements:
 - a. Agreement.
 - b. The General Conditions.
 - c. The Supplementary Conditions.
 - d. Other Owner requirements.
 4. Construction Documents:
 - a. Scopes of Work.
 - b. Temporary Facilities.
 - c. Use of Site.
 - d. Work Restrictions.
 - e. Alternates, Allowances, and Unit Prices.
 - f. Substitutions and Material Selection
 5. Separate Contracts:
 - a. Work of Other Contracts.



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6. Schedule:
 - a. Project Schedule.
 - b. Contract Time.
 - c. Damages.
 - d. Bidder Questions.

7. Site/facility visit or walkthrough.

- C. Minutes: The CM will record and may distribute meeting minutes and the sign in sheet to attendees via addenda. Minutes of meeting are issued as Available Information and do not constitute a modification to the Procurement and Contracting Documents. Modifications to the Procurement and Contracting Documents are issued by written Addendum only.

END OF SECTION 00 25 13



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SECTION 00 41 00 – BID FORM

LUMP SUM BID for BID PACKAGE # _____

Date: _____

TO: **RE Smith Construction Company**
1036 W. 2nd Street
Joplin, MO 64802
(417) 623-4545

COMPANY NAME:

(Hereinafter called "Bidder")

1. **The Bidder**, in accordance with the Drawings and Specifications, prepared by Paragon Architecture and RE Smith Construction Company for the project entitled:

Cassville Performing Arts Center

having examined the Drawings and Specifications with related documents and the site of the proposed work, and being familiar with all the conditions pertaining to the construction of the project and related work, including the availability of materials and labor, hereby proposes to furnish all labor, materials and supplies to construct the project in accordance with the Contract Documents, within the time set forth herein at the prices stated below. These prices are to cover all expenses, including any and all taxes and fees required by local ordinances, which are incurred in performing the work required under the Contract Documents, of which this Bid is a part.

2. **ADDENDA:**

The Bidder acknowledges receipt of the following addenda:

Addendum No. _____ dated _____
Addendum No. _____ dated _____
Addendum No. _____ dated _____
Addendum No. _____ dated _____



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3. BID PRICING:

In the following Bid, the amount shall be shown in both words and figures.

A. BASE BID:

The Bidder agrees to furnish all labor, materials, tools, and equipment required to complete the construction work shown on the Drawings and called for in the Specifications for the sum of:

_____ Dollars
\$(_____)

B. ALTERNATES: *Complete this section only when it is applicable to the Bid*

Package. (See Section 01 01 00 Summary of the Work for Alternate Descriptions)

- a. Bid Alternate #1 – Mezzanine Framing/Ladder/Door/Finishing at Loft 204
 - i. ADD \$ _____
- b. Bid Alternate #2 – Mezzanine Framing/Ladder/Door/Finishing at Loft 201
 - i. ADD \$ _____
- c. Bid Alternate #3 – Band Wall Sound Diffusers
 - i. ADD \$ _____
- d. Bid Alternate #4 – Band Ceiling Sound Diffusers
 - i. ADD \$ _____
- e. Bid Alternate #5 – Choir Wall Sound Diffusers
 - i. ADD \$ _____
- f. Bid Alternate #6 – Choir Ceiling Sound Diffusers
 - i. ADD \$ _____



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C. PERFORMANCE AND PAYMENT BOND:

Bidder shall state only the additional cost for adding a performance and payment bond to their Base Bid Pricing. \$ _____

D. UNIT PRICES: *Complete this section only when it is applicable to the Bid Package.*

1. Excavation of unclassified or unsuitable material haul off site \$_____/ cu.yd.
2. Excavation of unclassified or unsuitable material stockpile on site \$_____/cu.yd.
3. Additional Fill; in place from off-site material \$_____/cu.yd.
4. Engineered Fill; in place from off-site materials \$_____/cu.yd.
5. Additional Fill; in place from on-site material \$_____/ cu.yd.
6. Rock excavation:
 - 1) Mass Rock \$_____/per cu.yd.
 - 2) Trench Rock up to 10 feet below adjacent grade\$_____/ cu.yd.



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4. **BIDDER'S SIGNATURE:**

5. **BIDDER CONTACT INFO:**

Signature of Bidding Company Officer

Contact Name

Printed Name of Officer

Contact Phone Number

Company Address

Contact Email Address

(Each Bidder must complete the bid form by manually signing on the proper signature line above and supplying the required information called for in connection with the signature. The information called for is necessary in the proper preparation of the contract and performance bond. Each in the Bidder must supply the data called for "Statement of Bidder's Qualifications.") BY SIGNING ABOVE the Bidder acknowledges all descriptions and understands the items included in the contract documents that they are providing a proposal price for and all information explained and described in the BID FORM INFORMATION document included as pages 4 through 6 of this Bid Form.

NO MODIFICATIONS TO THE BID FORM ARE ALLOWED UNLESS SPECIFICALLY ALLOWED BY ADDENDA AND ONLY THEN SHALL MODIFICATION(S) BE ALLOWED. ONLY PAGES 1-4 OF THE BID FORM NEED TO BE SUBMITTED. NO QUALIFICATIONS, SUMMARY OF WORK, ETC., SHALL BE ATTACHED TO THE BID FORM OR INCLUDED WITH THE BID FORM IN THE SEALED ENVELOPE OF BID.



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BID FORM INFORMATION

1. UNIT PRICES:

For changing specified quantities of work from those indicated by the Contract Drawings and Specifications, upon written instructions of the Owner and CM, Unit Prices shall prevail in accordance with the General Conditions.

Unit Prices shall include all labor, overhead and profit, materials, equipment, appliances, bailing, shoring, shoring removal, and all costs require to cover the finished work of the several kinds of work called for.

Unit Prices are required where applicable to particular Base Bid and/or Alternates being submitted.

Only a single Unit Price shall be given and it shall apply for either MORE or LESS work than that shown on the Drawings or called for in the Specifications as indicated to be included in the Base Bid and/or Alternates. In the event that more or less units than so indicated are actually furnished, Change Orders will be issued for the increased or decreased amount as approved by the Architect and CM.

The Bidder understands that the Owner and CM will not be liable for any Unit Price or any amount in excess of the Base Bid and any Alternate(s) accepted at time of award of contract, except as expressed in written Change Orders duly executed and delivered by the Owner and CM.

2. PROJECT COMPLETION:

Commencement: Subcontractor agrees to commence work on this project as directed by the CM with-in 48 hours of Notice or as the Project Schedule dictates.

Lowest and Best Bid: The Subcontractor acknowledges time is of the essence for this project. The Subcontractor acknowledges and agrees that the Owner and CM reserves the option of selecting the Subcontractor based on the **Lowest and Best Responsible Bid**. The Bidder agrees to hold the Owner, Architect and CM harmless and will make no claim against the Architect, Owner or CM for awarding a Lowest Responsible Bid. Refer to Sect. 00 21 13 Instructions to Bidders, for clarification of issues the Owner and CM may choose to consider in determining lowest responsible bid.



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3. BIDDER'S ACKNOWLEDGMENTS:

The Bidder declares that he has had an opportunity to examine the site of the work and he has examined the Contract Documents therefore; that he has carefully prepared his Bid upon the basis thereof, that he has carefully examined and checked this Bid and the materials, equipment, and labor required thereunder, the cost thereof, and his figures therefor, and hereby states that the amount, or amounts, set forth in this Bid is, or are, correct and that no mistake or error has occurred in this Bid or in the Bidder's computations upon which this Bid is based, and the Bidder agrees that he will make no claim for reformation, modifications, revisions, or correction of this Bid after the scheduled closing time for the receipt of Bids.

In submitting this Bid, it is agreed that it may not be withdrawn for a period of thirty (30) calendar days after the scheduled closing time for receipt of Bids.

The Bidder understands that the Owner and CM reserves the right to award the contract to the lowest and best responsible bidder as they determine the definition there-in and to reject any or all bids and / or to waive any technicalities or informalities in the bidding.

4. BIDDER'S CERTIFICATE:

The Bidder hereby certifies:

- a) That his bid is genuine and is not made in the interest of, or on behalf of any undisclosed person, firm, or corporation, and is not submitted in conformity with any agreement or rules of any group, association or corporation.
- b) That he has not directly or indirectly induced or solicited any other bidder to; a) put in a false or sham bid, or b) not provide their supplier, manufacturer or subcontractors bids to the CM.
- c) That he has not solicited or induced any person, firm or corporation to refrain from bidding.
- d) That he has not sought by collusion or otherwise to obtain for himself any advantage over any other Bidder or over the Owner or CM.
- e) That he will not discriminate against any employee or applicant for employment because of race, color, religion, sex or national origin in connection with the performance of the work.



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- h) That he is familiar with the requirements for primary responsibility to coordinate the work and will comply with the conditions of the contract and cooperate with the Architect and CM in fulfilling his administration responsibilities to the contract.
- i) That he will comply with requirements for the Project Schedule and that schedule will become one of the communication devices for communicating project progress to the CM, Architect, Owner.
- j) That Lowest and Best Responsible Bid will prevail over Lowest Bid.
- k) That this is a Prevailing Wage Project and the bid reflects inclusion of this requirement.
- l) That this project DOES qualify for Material Tax Exempt Status and the bid reflects exclusion of state, local and federal taxes on material.

END OF SECTION 00 41 00



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SECTION 00 96 00 - AFFIDAVITS

Included in this Section:

1. **Affidavits:**
 - a. Vendor No Tax Due
 - b. OSHA 10 Hour Construction Training
 - c. Criminal Background Check
 - d. Drug & Alcohol Policy

COMPLETED Affidavits to be delivered (emailed) by Subcontractor to CM at most 24 hours after notice to proceed is provided to the awarded Subcontractor.

BIDDERS NOTE: If your company does not comply with these programs you will not be deemed qualified to be awarded a subcontract agreement on this project.



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VENDOR NO TAX DUE

In accordance with Section 34.040.6 RSMO, Crowder College in Newton County Missouri is precluded from contracting with a vendor or its affiliate who makes sales at retail of tangible personal property or for the purpose of storage, use or consumption in this state but fails to collect and properly pay the tax as provided in RSMO 144.

In order for RE Smith Construction and Crowder College to be able to consider your response to your proposal provided for the project described in the header of this page above, you must verify that you are either registered to collect sales and/or use tax in Missouri, or you are not making retail sales of tangible personal property or providing taxable services in Missouri. You can provide this verification by submitting an official “Vendor No Tax Due” certificate issued by the Missouri Department of Revenue. The Department of Revenue will issue the “Vendor No Tax Due” certificate if you are properly registered to collect and have properly remitted sales and/or use tax, or if you are not making retail sales in Missouri. Once the “Vendor No Tax Due” certificate is issued, submit it NO LATER THAN bid due date and to the address noted below.

If you do not provide the “Vendor No Tax Due” certificate by the date specified above and/or maintain a compliant tax status, it may render your bid unacceptable for further consideration.

You may obtain a “Vendor No Tax Due” certificate by contacting the Missouri Department of Revenue. The attached document provides information on how to obtain the “Vendor No Tax Due” certificate. Additional information regarding Section 34.040.6 RSMO is available on the Department of Revenue’s website at <http://www.dor.mo.gov/tax/business/sales/hb600.htm>.

If you are not already registered as a vendor with the State of Missouri, you are encouraged to register on the state’s On-Line Bidding/Vendor Registration System website (<https://www.moolb.mo.gov>). Instructions for registering on this website are available on the Home page of the website.

Thank you for your attention to this urgent matter.

See Next Page.....

How to Obtain A Certificate Of Vendor No Tax Due



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A certificate of vendor no tax due can be obtained from the Missouri Department of Revenue when a business pays all of its sales/use tax in full, up to date, does not have a sales tax delinquency or does not sell tangible personal property at retail in Missouri.

If taxes are due, depending on the payment history of the business, a cashier's check or money order may be required for payment before a certificate of vendor no tax due can be issued.

A certificate of vendor no tax due can be obtained by contacting the Missouri Department of Revenue, Division of Taxation & Collection, P.O. Box 3666, Jefferson City, MO 65105-3666. You may also call (573) 751-9268, fax (573) 522-1160, or email taxclearance@dor.mo.gov, or complete and fax the Request For Tax Clearance, Form 943, located at <http://dor.mo.gov/tax/misc/forms/943f.pdf>. If you elect to complete the Request for Tax Clearance, Form 943, make sure you check item 4 in the Reason For Request section. For walk-in assistance, you can visit a Tax Assistance Center near you:

Jefferson City
301 West High Street, Room 330

St. Louis
3256 Laclede Station Rd., Ste 101

Kansas City
615 E 13th St., Room 127

Columbia
1500 Vandiver Drive, Room 113

Cape Girardeau
3102 Blattner Dr., Suite 102

St. Joseph
525 Jules, Room 314

Springfield
149 Park Central Square, Room 313

Joplin
705 Illinois Avenue, Suite 4



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**Affidavit of Compliance with Section 168.133 R.S.Mo., Et Seq.
CRIMINAL BACKGROUND CHECK**

STATE OF _____)
) ss.
COUNTY OF _____)

Before me, the undersigned Notary Public, in and for the County of _____,
State of _____, personally appeared _____ (Name)

who is _____ (Title) of _____ (Name of company),
(a corporation), (a partnership), (a sole proprietorship), (a limited liability company),

and is competent and authorized to make this affidavit, and being duly sworn upon oath deposes and says as follows that:

1. said company has verified the backgrounds with respect to its employees working in connection with the contracted services for the project named above and that all employees of said company have cleared/passed a background check as administered by the MO State Highway Patrol or similar checking entity.
2. said company has on hand and readily available the list of approved screened personnel and will provide to the Contractor or Owner when/if requested within 24 hours.
3. said company will not allow any employees or personnel of its company on the project that have not cleared/passed a background check (as identified in 1. above).

The terms used in this affidavit shall have the meaning set forth in Sections 168.133 R.S.Mo., et seq. or as equal determined language as adopted by the Owner of this project.

Signature

Name: _____

Subscribed and sworn to before me this _____ day of _____, _____.

Notary Public

My commission expires: _____



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**Affidavit of Compliance with Section 161.371 R.S.Mo., Et Seq.
RANDOM DRUG & ALCOHOL TESTING PROGRAM**

STATE OF _____)
) ss.

COUNTY OF _____)
Before me, the undersigned Notary Public, in and for the County of _____,

State of _____, personally appeared _____ (Name)

who is _____ (Title) of _____ (Name of company),
(a corporation), (a partnership), (a sole proprietorship), (a limited liability company),

and is competent and authorized to make this affidavit, and being duly sworn upon oath deposes and says as follows that:

1. Pursuant to the State of Missouri's RSMo Section 161.371, the Contractor and any subcontractors on public works projects shall establish and implement a random drug and alcohol testing program. Said drug and alcohol testing program shall be administered by a laboratory duly certified by the U.S. Department of Health and Human Services, or similar agency approved by the office of administration. Such program shall require notification to the employer and employee of the results of any positive drug and alcohol test and the school district shall be notified of the action taken to protect the safety of students as a result of such positive test
2. All costs for the program of screening and testing workers for alcohol and controlled substances, as well as all costs for administration of such drug and alcohol testing program shall be paid by the employer on the public works project. No costs under this section shall be paid by the state, any of its agencies, or any political subdivision thereof
3. said company has on hand and readily available the list of approved screened personnel and will provide to the Contractor or Owner when/if requested within 24 hours.
4. said company will not allow any employees or personnel of its company on the project that have not cleared/passed a background check (as identified in 1. above).

The terms used in this affidavit shall have the meaning set forth in Sections 161.371 R.S.Mo., et seq. or as equal determined language as adopted by the Owner of this project.

Signature

Name: _____

Subscribed and sworn to before me this _____ day of _____, _____.

Notary Public

My commission expires: _____



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END OF SECTION 00 96 00



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SECTION 01 01 00 - SUMMARY OF THE WORK

RELATED DOCUMENTS

Drawings and general provisions of Contract including Division 00, General and Supplementary General Conditions and other Division 01 Specification Sections apply to this Section. This section is intended to assist the bidder in understanding the scope of work included in the documents. Work described herein is for orientation; refer to the Documents for the specific scope of work.

Summary of the Work Section includes:

1. Project information
2. Owner Occupancy
3. Work by Owner (Owner Furnished Products or Work Under Separate Contracts.)
4. Use of Site and Premises and Restrictions
5. Accessibility Standards
6. Alternates
7. Unit Prices

PROJECT INFORMATION

The CM is soliciting bids for this project through multiple bid packages from subcontractors. Refer to Scopes of Work in Section 00 20 00.

The Project is construction of a new Performing Arts Center for the Cassville School District located on the South side of the High School located at 1825 State Hwy Y, Cassville, MO 65625. The project consists of Site Demo, Site Grading, Site Utilities, Asphalt Paving, Concrete, Structural Steel, Metal Stud Framing, Rough Carpentry, Doors, Windows, Hardware, Overhead Doors, Gypsum Board, ACT Ceiling, Flooring, Painting, Specialties, Auditorium Seating, Pre-Engineered Metal Building with Standing Seam Roof and Metal Wall Panels, Fire Sprinkler, Plumbing, HVAC, and Electrical.

Project Name: Cassville Performing Arts Center

Owner's Name: Cassville R-IV School District

Architect's Name: Paragon Architecture, LLC.

Construction Manager's Name (aka Contractor): RE Smith Construction Company

Project Website: A project website, on Procore, paid for and administered by the Contractor, will be used for purposes of managing communication and all documentation during the project.



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ALL entities involved in the project will be required to use the website as the Contractor outlines and sees fit.

OWNER OCCUPANCY

- A. Owner intends to occupy a certain portion of the Project prior to the completion date for the conduct of normal modified operations.
- B. Cooperate with the Owner and CM to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work with the CM to accommodate Owner occupancy.
- D. **Partial owner Occupancy:** The Owner reserves the right to limited occupancy during construction. Limited occupancy is directed toward placing and installing Furnishings, Fixtures, and equipment in areas of the building (s), provided that such occupancy does not interfere with completion of the Work. Such placing of equipment and partial occupancy shall not constitute acceptance of Work. The contractor shall as a part of his work provides coordination and scheduling to allow the owners work, or work by separate contractors of the owner, and staff, to be done.

WORK BY OWNER

- A. General: Cooperate fully with Owner and/or Owner's separate Contractors so work may be carried out smoothly, without interfering with or delaying work under this Contract, work under separate contract, or work by Owner. Coordinate the Work of this Contract with other contracts and with work performed by the Owner.
- B. Concurrent Work: Owner will or has awarded separate contract(s) or self-perform the following construction operations at Project site. Those operations will be conducted simultaneously with work under this Contract. Coordinate scheduling of the work with Owner, as some work by other contractors may be required prior to close-in of spaces.
 - a. Computer equipment.
 - b. Structured cabling.
 - c. Communications and security devices, including access control. Reference plans and specs for any conduit, boxes, and cabling included in this contract.
 - d. Projection screens, projectors, televisions, and sound systems, which may be required, unless included in specifications or drawings as being in the contract.
 - e. All moveable furniture, unless specifically noted on drawings or in specifications as being in the contract.
 - f. Residential appliances and vending machines, unless specifically noted on drawings or in specifications as being in the contract.
 - g. Landscaping and site appurtenances, unless specifically noted on drawings or in specifications as being in the contract.
 - h. Relocation of existing storage shed.
 - i. Miscellaneous items or equipment specifically noted on the plans to be provided by the Owner.



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- j. Cooperate and coordinate with Owner and Owner's Contractor's for installation of miscellaneous equipment and furnishings, subject to agreement, regarding insurance, security, and liability.

CONTRACTOR USE OF SITE AND PREMISES & RESTRICTIONS

- A. Construction Operations: Coordinate with Construction Manager.
 - a. Locate and conduct construction activities in ways that will limit disturbance to site and that comply with other requirements of the authorities having jurisdiction.
 - b. Arrange use of site and premises to allow:
 - i. Owner occupancy.
 - ii. Work by Others.
 - iii. Work by Owner.
 - iv. Use of site and premises by the public.
 - c. Provide access to and from site as required by law and by Owner:
 - i. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - ii. Do not obstruct roadways, sidewalks, or other public ways without permit.
 - d. Utility Outages and Shutdown:
 - i. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - ii. Prevent accidental disruption of utility services to other facilities.
 - iii. Coordinate construction schedule and operations with Construction Manager and Owner.
- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated.
 - a. Notify Owner not less than three business days in advance of proposed utility interruptions and coordinate any interruptions with Owner activities and operations. Coordinate with Owner as to interruptions and duration. Contractor should anticipate possibility of some work being conducted over weekends, nights, holidays, or school breaks to minimize interruption of Owner's operations.
 - b. Obtain Owner's written permission before proceeding with utility interruptions.
- C. Noise, Vibrations, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
 - a. Notify Owner not less than three business days in advance of proposed disruptive operations.
 - b. Obtain Owner's written permission before proceeding with disruptive operations.



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- D. Controlled Substances, Smoking, Vaping & Alcohol Policy: Vaping, Smoking or use of tobacco products **will not be allowed in any of the buildings or at any areas on site.**
 - a. Alcoholic products will not be allowed on site any time.
 - b. Controlled Substances will not be allowed on site any time in any form.
- E. Employee Identification: Provide identification tags for Contractor personnel working on the Project site if required by Owner. Require personnel to utilize identification tags at all times. Provide Owner with a list of all workers on site. See Contractors Sign-In Program. ALL Contractors shall wear attire that bears their company name at all times while on site.
- F. Construction Manager, Contractors and Sub-Contractor's Participation in a Drug Testing Program as required by RSMo Section 161.371. Affidavit completion is required.

ACCESSIBILITY STANDARDS AND PROVISIONS FOR THE HANDICAPPED:

The project is to comply with the following standards:

IBC 2018 American National Standard ICC/ANSI 117/1-2003 Americans with Disabilities Act and Architectural Barriers Act Accessibility Guidelines 2010 ED. It is a part of this project. (ADAAG)

The designers have endeavored to comply with these standards as the project design has developed. It is required of this contract that the Contractor and those trades involved in the execution of the work, and tradesmen familiar with the detailed requirements of accessibility, notify the architect of deficiencies, or non compliance should they become aware of the inconsistency.

Nothing in this requirement is intended to extend design responsibility to the constructors and requirement of the Conditions of the contract. Designers are making every effort to have a compliant accessible facility and seek your review and input in achieving it.

ALTERNATES:

- A. Section includes administrative and procedural requirements for alternates.
- B. DEFINITIONS
 - a. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the Bidding Requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in



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the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

- i. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
- ii. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
- iii. Subcontractor shall hold all alternate bid prices for 30 days from date of contract award, unless specifically noted otherwise.

C. PROCEDURES

- a. Coordination: Modify or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - i. Include as part of each alternate, related coordination, modifications, adjustments, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
 - ii. Notification: Immediately following award of the Contract or NTP , notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.
 - iii. Execute accepted alternates under the same conditions as other work of the Contract.
 - iv. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials and methods necessary to achieve the work described under each alternate.
 1. Include as part of alternate, miscellaneous devices, appurtenances and similar items incidental to or required for complete installation whether or not mentioned as part of alternate.

D. SCHEDULE OF ALTERNATES

- a. Alternate #1 – ADD Mezzanine Framing/Ladder/Door/Finishing at Loft 204
- b. Alternate #2 – ADD Mezzanine Framing/Ladder/Door/Finishing at Loft 201
- c. Alternate #3 – ADD Band Wall Sound Diffusers (see sheet A7-4)
- d. Alternate #4 – ADD Band Ceiling Sound Diffusers (see sheet A7-4)
- e. Alternate #5 – ADD Choir Wall Sound Diffusers (see sheet A7-4)
- f. Alternate #6 – ADD Choir Ceiling Sound Diffusers (see sheet A7-4)



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UNIT PRICES:

A. DEFINITIONS

- a. Unit price is an amount incorporated in the Agreement, as proposed by Bidders and stated on the Bid Form, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

B. PROCEDURES

- a. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, Contractor's and Sub-Contractor's overhead, and profit and any other related costs for completed work.
- b. Measurement and Payment: Refer to individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- c. Contractor shall notify Architect and Owner immediately upon uncovering any unanticipated conditions before proceeding with removal and/or replacement of any items identified below under unit cost schedule.
- d. Contractor shall include as part of this bid and this contract, amounts of items listed as unit prices, necessary for the completion of the Work. Unit prices listed below shall be listed only to determine prices of changes to the Work. Unit prices shall include materials, labor, transportation, Contractor's and Sub-contractor's overhead and profit, and any other related costs for complete installation.
- e. List of Unit Prices: A schedule of unit prices is included at the end of this section and the schedule contains requirements for materials described under each unit price.

C. SCHEDULE OF UNIT PRICES

- a. Contractor shall include as part of this bid and this contract, amounts for items listed as unit prices, necessary for the completion of the work. Unit prices listed below shall be listed only to determine prices of Changes to the Work. Unit prices shall include materials, labor, transportation, Contractor's (and subcontractors) overhead and profit; and any other related costs for a complete installation.
 - i. Unit Price No. 1: Site and Earthwork: Unit costs identified below for are for unanticipated conditions which may arise during excavations that are not part of the work required by the Contract Documents. Contractor shall include in the base bid all work required and that can be reasonably



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anticipated based on the Contract Documents and on-site observations. Unit prices shall be listed only to determine prices of changes to the work. Contractor shall notify Architect and Owner immediately upon uncovering any unanticipated conditions before proceeding with removal and/or replacement of any items identified below under unit cost schedule.

- b. Description: Unsatisfactory soil or rock excavation, disposal and replacement with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 31 Sections as applicable.
 1. Excavation of unclassified or unsuitable material haul off site per cu.yd.
 2. Excavation of unclassified or unsuitable material stockpile on site per cu.yd.
 3. Additional Fill; in place from off-site material per cu.yd.
 4. Engineered Fill; in place from off-site materials per cu.yd.
 5. Additional Fill; in place from on-site material per cu.yd.
 6. Rock excavation:
 - a. Mass Rock per cu.yd.
 - b. Trench Rock up to 10 feet below adjacent grade per cu.yd.

END OF SECTION 01 01 00

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.2 RELATED REQUIREMENTS

- A. Section 002113 - Instructions to Bidders: Restrictions on timing of substitution requests.
- B. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.3 DEFINITIONS

- A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.4 REFERENCE STANDARDS

- A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage) Current Edition.
- B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase) Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

- A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.
 - 4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
 - 5. Waives claims for additional costs or time extension that may subsequently become apparent.
- B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.
- D. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

- A. Submittal Time Restrictions:
 - 1. Section 002113 - Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.
- B. Submittal Form (before award of contract):

1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

- A. Submittal Form (after award of contract):
 1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request, or equivalent form. See this form for additional information and instructions.
- B. Architect will consider requests for substitutions only within 60 days after date of Agreement.
- C. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
- D. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 60 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.
 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.
- E. Substitutions will not be considered under one or more of the following circumstances:
 1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
 2. Without a separate written request.

3.4 RESOLUTION

- A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.
- B. Architect will notify Contractor in writing of decision to accept or reject request.

END OF SECTION



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SECTION 01 26 00 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification sections, apply to this section.

1.2 SUMMARY

- A. This section specifies administrative and procedural requirements for handling and processing Contract modifications.
 - 1. Division 1 Section "Unit Prices" for administrative requirements governing use of unit prices.
 - 2. Division 1 Section "Application for Payment" for administrative procedures governing applications for payment.
 - 3. Division 1 Section "Product Substitutions" for administrative procedures for handling requests for substitutions made after award of the Contract.

1.3 CHANGES IN THE WORK

A. Supplemental instruction (SI)

- 1. This document authorizing minor changes in the Work, not involving an adjustment to the Contract Sum or Contract Time, will be issued by the Architect on AIA form G710, Architect's Supplemental Instructions or similar document to the CM. If the Owner so agrees the CM shall issue the SI. The Supplemental Instruction (SI) is also used as a tool for summarizing actions. If a Subcontractor expects a cost for the work of the SI, then they will provide a COR per item B.1. below after notifying the CM in writing and gaining approval to do so by the CM.

B. Proposal Request (PR)

- 1. Both the Architect and the CM may initiate and issue a **PR** (Proposal Request). The subcontractor will respond no later than 96 hours after PR is released, if a claim is anticipated, as a **COR** (Change Order Request). The COR will include a suggested project cost (addition or deduction) and suggested time increase or decrease. If no claim is to be made for time or monies the issue will then be de-elevated to an SI. **To allow work to proceed timely between Change Order Approvals which are done at least monthly, an email or other written**



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communication or a COR signed by the CM or Architect or Owners Representative will allow work to proceed with the recognition that the formal Change Order will incorporate that COR into the work. All DIRECTION of approval will come from the CM to the Subcontractor.

2. Owner/CM Initiated Proposal Requests: (PR) Proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time will be issued by the CM or Architect, with a detailed description of the proposed change and supplemental or revised Drawings and Specifications as required. Change Orders are to be kept up to date and current, to allow the CM and Owner to monitor the project budget.

3. Proposal requests issued by the Architect are for information only. Do not consider them an instruction either to stop work in progress, or to execute the proposed change.

4. Unless otherwise indicated in the proposal request, within 7 days of receipt of the proposal request, submit to the Architect for the Owner's review an estimate of cost necessary to execute the proposed change.

a. Include a list of quantities of products to be purchased and unit costs, along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

c. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

C. CM or Subcontractor-Initiated Change Order Requests: When latent or other unforeseen conditions require modifications to the Contract, the Contractor may propose changes by submitting a request for a change to the Architect.

1. Include a statement outlining the reasons for the change and the effect of the change on the Work within 7 days of occurrence of cause for change. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

2. Include a list of quantities of products to be purchased and unit costs along with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.

4. Comply with requirements in Section "Product Substitutions" if the proposed change in the Work requires the substitution of one product or system for a product or system specified.

1.4 UNIT COST ALLOWANCES (If required/included in project)

A. Allowance Adjustment: Base each Change Order Request for an allowance cost



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adjustment solely on the difference between the actual purchase amount and the unit cost allowance, multiplied by the final measurement of work-in-place, with reasonable allowances, where applicable, for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Submit substantiation of a change in scope of work claimed in the Change Order Request related to unit-cost allowances.
2. The Owner reserves the right to verify and modify the actual quantity of work-in-place by independent quantity survey, measure, or count.

B. Claims must be submitted for increased costs within 10 days of the occurrence.

1.5 CONSTRUCTION CHANGE DIRECTIVE (Force Account)

- A. Construction Change Directive (**CCD**): When the Owner and Contractor are not in total agreement on the terms of a Change Order Proposal Request, the contractor may be required to proceed with the work through the CCD Process. the Architect may issue a Construction Change Directive on AIA Form G714, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. **Terms will be based on time and material with allowed mark-up.** Work will be monitored by a designate of the Owner's representative.
1. The Construction Change Directive will contain a complete description of the change in the Work and designate the method to be followed to determine change in the Contract Sum or Contract Time.
 2. Requirements listed below for Change Orders apply to Construction Change Directives in determining changes to the Contract Sum or Time.
 3. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
 4. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.
 5. Ultimately the CCD becomes a Change Order.

1.6 CHANGE ORDER PROCEDURES

- A. Upon the Owner's approval of a Change Order Request, **the CM** will issue a **Change Order** for signatures of the Owner and Architect on form similar to the AIA Form G701, as provided in the Conditions of the Contract. Changes to the work will be kept current on a monthly basis.
To allow for timely decisions affecting work, the COR's are typically processed in weekly intervals as needed to keep the work flowing smoothly.
- B. Submit a complete itemized list of all material and labor in each proposal for change items as shown by example of attached sample itemized proposal.
- C. Deductive Change Orders shall include costs of the work plus percentages for contractor mark up to be deducted.



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- D. Pre-approval of a COR: To accelerate decision making and assure the project proceeds in a timely manner, the Owner may entertain pre approving a Change Order Request. This is essentially a statement by the Owner that a Change Order will be accepted when processed in the future. The approved COR must be signed by the Contractor, Architect, and Owner to become an approved document.
- E. In all cases of changes, change orders etc., the Subcontractors and Suppliers shall provide time and cost changes per the project manual no later than 7 days to the CM after the request is made available. It is not the responsibility of the CM, Design Team or Owner to alert Subs or Suppliers to changes in the work that have been released. It is the responsibility of the Sub and Supplier to make every effort to review and communicate appropriately with the CM to verify if and when changes occur. If a Sub or Supplier neglects, by no fault of the the CM, Owner or Design Team to provide costing or time changes to a specific change the burden of cost to provide the change required falls solely on the Subcontractor and they shall do the work of the required change at no cost to the CM, Owner or Design Team.

1.7 MAXIMUM ALLOWANCE FOR OVERHEAD AND PROFIT & LABOR BURDEN on Change Orders: (THE CMs OHD and PROFIT shall be per their agreement with the Owner).

- A. Labor costs per hour shall be included with labor burden identified, which shall not be less than actual labor rate. Identify any labor burden costs over and above the prevailing wage rate. Labor burden costs shall not include overhead and profit charges as identified below.
- B. The overhead and profit charge by the Contractor and all subcontractors shall be considered to include, but is not limited to: job site office expense, incidental job burdens, truck expense including mileage, small hand tools, project supervision including field supervision, company benefits and general office overhead. Percentages for overhead and profit charged for Change Orders shall be negotiable and may vary according to the nature, extent and complexity of the work involved. Percentage mark ups provided herein are intended to include the costs associated with all delay, disruption, extended job site presence and home office overhead resulting from the changed work.

C. The maximum allowable Overhead and Profit is a condition of the Contract and shall be as follows:

	<u>Not to Exceed</u>
A. To Contractor and Subcontractor for work performed by his own forces	10%
B. To Contractor and Subcontractor for work performed by	10%



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other than his own forces

- C. To Contractor and Subcontractor's Suppliers and Lower Tier Subcontractors 10%
for work performed or provided to the Subcontractor for this contract

Percentages for overhead and profit will not be allowed on applicable taxes and bond Premiums. No Supervision or General Conditions or General Requirement costs will be allowed on any Change Orders or COR's unless approved by the CM.

- E. On proposals covering both increases and decreases in the amount of this contract, the application of overhead and profit shall be on the net change in the cost of the work. Proposals must show items to be deleted, if any, and the cost of the change shall be the result of the net difference to the base contract. Proposals are **not** to be determined by a re-bid of the entire scope of work although the CM reserves the right to solicit pricing from other Subcontractors when the Subcontractor does not provide pricing per the contract documents or where changes significantly alter the entire scope of a particular bid package. Significant change is defined as altering more than 25% of the bid packages scope or contract amount.
- F. Change Orders shall be kept current within the month of the incident leading to the claim and may only be billed once approved Change Orders have been executed or the CM's Project Manager makes special approval for billings.

1.8 Submit a complete itemized list of all material and labor in each proposal for change items as shown by example of attached sample itemized proposal.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

PART 4 - SAMPLE SHEET (ATTACHED)



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PART 4 - SAMPLE

SAMPLE PRICING SHEET

Project: Sprinkler Modification for XYZ Company
 Location: Chicken Butt, Missouri
 Labor Rate: \$27.00
 Date: February 27, 2023
 Estimator: Joe Smith

Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hrs.	
6" Tee	1	each	\$45.00	2.000	2.0	\$ 45.00
less 6" ell	1	each	\$30.00	0.000	0.0	30.00
6" sch 40 pipe	15	feet	\$10.43	0.253	3.8	156.45
6" cap	1	each	\$11.00	1.500	1.5	11.00
6" hanger	1	each	\$12.00	0.400	0.4	12.00
4" saddle weld	1	each	\$ 0.00	1.200	1.2	0.00
4" sch 40	18	feet	\$ 4.44	0.183	3.3	79.92
4" ell	3	each	\$13.39	2.000	6.0	40.17
4" hanger	3	each	\$ 8.00	0.300	0.9	24.00
4" weld	1	each	\$ 3.00	1.000	1.0	3.00
1-1/2" cond sch 80	21	feet	\$ 1.63	0.080	1.7	34.23
1-1/2" ell	3	each	\$ 4.00	0.400	1.2	12.00
1-1/2" tee	1	each	\$ 5.00	0.600	0.6	5.00
1-1/2" weld	1	each	\$ 3.00	0.400	0.4	
7.20						
3/4" tee	1	each	\$ 1.50	0.300	0.3	1.50
3/4" ell	3	each	\$ 0.95	0.200	0.6	2.85
3/4" hanger	2	each	\$ 2.50	0.200	<u>0.4</u>	<u>5.00</u>
SUBTOTAL					28.4	\$ 618.47
SALES TAX (if applicable)			6.125%			37.88
LABOR	28.4	MH		\$27.00		<u>765.96</u>
SUBTOTAL						\$1422.31
10% OVERHEAD AND PROFIT						<u>142.23</u>
TOTAL						\$1,564.54

END OF SECTION 01 26 00



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SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 *NOTE: SUBCONTRACTORS SHALL UPLOAD 1 DOCUMENT PER SUBMITTAL ITEM REQUIREMENT. DO NOT UPLOAD/PROVIDE MULTIPLE DOCUMENTS FOR ONE SUBMITTAL ITEM REQUIREMENT. IF A SUBCONTRACTOR UPLOADS MULTIPLE DOCUMENTS FOR A SINGLE SUBMITTAL ITEM REQUIREMENT THE CM RESERVES THE RIGHT TO REJECT OR CHARGE 1 DAY OF DELAY DAMAGES TO THE SUBCONTRACTOR TO COMPILE THE DOCUMENTS INTO THE PROPER FILE.

1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 00 and 01 Specification Sections, apply to this Section.

1.3 SUMMARY

- A. This Section includes utilization of EITHER a web based platform: **Procore/Submittal Exchange or Electronic Mail (e-mail)** as the tool for administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
1. Email Submittals – **ONLY as directed by CM**

ELECTRONIC SUBMITTAL PROCEDURES – Procore/Submittal Exchange

- A. Summary:
1. Shop drawing and product data submittals shall be transmitted via upload to CM in electronic (PDF) format using Submittal Exchange/Procore, a website service designed specifically for transmitting submittals between construction team members.
 2. The CM will review all submittals and re-upload for Architect/Engineer Review
 3. It is the subcontractor's responsibility to track their own submittals. For example, if the Bid Package 03 Concrete Subcontractor submits the reinforcing shop drawings to the CM it is THE SUBCONTRACTOR'S DUTY to follow-up with the CM to



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make sure that the submittal was received and when it is expected to be completely reviewed. IT IS NOT THE CM'S RESPONSIBILITY TO follow-up with the Subcontractor and delay damages will be assessed to all Subcontractors who fail to provide submittals in ample enough time to have their products reviewed to be able to order and then install per the schedule.

4. The Architect will then release the submittal marked as Reviewed, Reviewed with Notes, Revise and Re-Submit or Rejected (or similar verbiage)
5. It is the subcontractors responsibility to monitor the website for activity.
 - a. (E-mail invitation will be sent to each subcontractor by the CM after Award of Contract. Free Training is available through the web-based platform for all participants but must be set-up between the participant and the web-based platform service.)
6. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
7. The electronic submittal process is not intended for color samples, color charts, or physical material samples which will need to be MAILED to the CM for review prior to the CM transmitting to the Architect.

B. Procedures:

1. Submittal Preparation – CM(Contractor) may use any or all of the following options:
 - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the project website.
2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements and intent of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. Contractor shall transmit each submittal using the project website. IF the project is set-up with this platform of deliverables.
4. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Subcontractor will receive email notice of completed review in most cases but it is the responsibility of the Subcontractor to monitor the project website for changes and new uploads.
5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the CM and will be done electronically through Submittal Exchange/Procore.
6. The Contractor requires each subcontractor to submit **1 paper copy** of all reviewed submittals of the products approved to be as work in place at project closeout for record purposes in accordance with Section 017800 – Closeout Submittals along with all required closeout documents.



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ELECTRONIC SUBMITTAL PROCEDURES – Electronic Mail (e-mail) – ONLY WHEN APPROVED BY CM

A. Summary:

1. Shop drawing and product data submittals shall be transmitted via email to the CM in electronic (PDF) format.
1. The CM will review all submittals and transmit for Architect/engineer Review
2. The Architect will then transmit the submittal marked as Reviewed, Reviewed with Notes, Revise and Re-Submit or Rejected (or similar verbiage) via email back to the CM.
3. It is the subcontractor's responsibility to track their own submittals. For example, if the Bid Package 03 Concrete Subcontractor emails the reinforcing shop drawings to the CM it is THE SUBCONTRACTOR'S DUTY to follow-up with the CM to make sure that the submittal was received and when it is expected to be completely reviewed. IT IS NOT THE CM'S RESPONSIBILITY TO follow-up with the Subcontractor and delay damages will be assessed to all Subcontractor's who fail to provide submittals in ample enough time to have their products reviewed to be able to order and install per the schedule.
4. The intent of electronic submittals is to expedite the construction process by reducing paperwork, improving information flow, and decreasing turnaround time.
5. The electronic submittal process is not intended for color samples, color charts, or physical material samples which will need to be MAILED to the CM for review prior to the CM transmitting to the Architect.

B. Procedures:

1. Submittal Preparation – CM(Contractor) may use any or all of the following options:
 - a. Subcontractors and Suppliers provide electronic (PDF) submittals to Contractor via the Submittal Exchange/Procore website.
2. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements and intent of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
3. Contractor shall transmit each submittal using the Procore , www.procore.com or Submittal Exchange website, www.submittalexchange.com. IF the project is set-up with this platform of deliverables.
4. Architect / Engineer review comments will be made available on the Submittal Exchange website for downloading. Subcontractor will receive email notice of completed review in most cases but it is the responsibility of the Subcontractor to monitor the project website for changes and new uploads.



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5. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the CM and will be done electronically through the project website.
6. The Contractor requires each subcontractor to submit **1 paper and 1 digital copy** of all reviewed submittals at project closeout for record purposes in accordance with Section 017800 – Closeout Submittals along with all required closeout documents.
- C. Costs:
Each Subcontractor must include in their proposal, an allowance amount of \$500.00 (five hundred dollars) for their company's use of Submittal Exchange/Procore/Project Website services. Before Substantial Completion, this allowance amount will be transmitted to the CM by the Subcontractor in the form of a deductive change order.
- D. Internet Service and Equipment Requirements:
- a. Email address and Internet access at Subcontractor's main office or readily available device with the ability to accept, send and view websites and email.
 - b. Adobe Acrobat (www.adobe.com)
 - c. Bluebeam PDF Revu (www.bluebeam.com), or other similar PDF review software for applying electronic stamps and comments.

1.4 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires CM or Architect's responsive action.
- B. Informational Submittals: Written information that does not require CM, Architect's or Owner's Representative's approval. Submittals may be rejected for not complying with requirements or marked as Not Reviewed or similar.

1.5 SUBMITTAL PROCEDURES:

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will be provided by Architect and Engineer for Contractor's use in preparing submittals at NO COST to the CM or Sub or Supplier as they understand the need for these files. Request documents through the CM. The CM and Subcontractor accept all risk when accepting these types of files and hold harmless and relieve the Design Team and Owner of all responsibility for correctness or accuracy.



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- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities and the Project Schedule.
1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals, return, and re-edit submittals returned for modification, concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Section 00 20 00 Scopes of Work attachment of Submittal Schedule and Division 1 for list of submittals and time requirements for scheduled performance of related construction activities. Subs and Suppliers shall PROVIDE the CM with a detailed .pdf list of all submittals both action and closeout, within 10 days following the NTP and/or contract agreement or PO.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal.
1. Initial Review: Allow 7 working days for initial review of each submittal. Allow additional time if processing must be delayed to permit coordination with subsequent submittals. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Special Speed Submittal Processing: A special appeal in writing may be made by the CM to the Architect to expedite a submittal. (This is to speed the ordering or shop drawings process.) The Owner and Contractor agree hastened documents can result in omission and errors. Consequently, each agrees to hold the A/E harmless for lapses and omissions that can occur as a result of accelerated reviews.
 3. If intermediate submittal is necessary, process it in same manner as initial submittal.
 4. Allow 10 working days for processing each resubmittal.
 5. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing.
- E. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.



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2. Provide a space approximately **4 by 5 inches** on label or beside title block to record Contractor's review and approval markings and action taken by Architect and Owner's Representative.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of CM.
 - e. Name and address of subcontractor.
 - f. Number and title of appropriate Specification Section.
 - g. Other necessary identification.
- F. Deviations: Highlight, encircle, or otherwise identify deviations from the Contract Documents on submittals.
- G. Additional Copies:
 1. When requested in writing by Owner, Architect, CM.
- H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will return submittals, without review, received from sources other than Contractor. The Contractor must stamp submittals approved prior to review by the Architect.
- I. Use for Construction: Use only final submittals with mark indicating action taken by Architect in connection with construction. Refer to Submittal Log for determining Dates of the Final Submittal.
- J. Verification of field conditions and measurements prior to fabrication and delivery: Actual condition field measurement prior to fabrication is the responsibility of the Contractor/subcontractors. Do not rely on design documents as a resource for fabrication and installation. Field conditions change or often deviate from designed condition.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.



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1. Submit to project website unless otherwise requested in writing.
 2. Number of Copies: Submit copies of each submittal, as follows, unless otherwise indicated:
 - a. Sample Submittal: Submit 3-each physical samples where selection of options, color, pattern, texture, or similar characteristics is required. Architect or Owner will return submittal to CM with options selected and CM will then transmit the accepted information to Sub or Supplier.
 - b. Final Submittal: Submit one paper copy where required for All warranty, operation and maintenance information to the CM when requested. CM will transmit to Architect for Approval and upon that approval the Architect will transmit to Owner's Representative and he will retain the Manual.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.
 - d. Standard color charts.
 - e. Manufacturer's catalog cuts.
 - f. Wiring diagrams showing factory-installed wiring.
 - g. Printed performance curves.
 - h. Operational range diagrams.
 - i. Standard product operating and maintenance manuals.
 - j. Compliance with recognized trade association standards.
 - k. Compliance with recognized testing agency standards.
 - l. Application of testing agency labels and seals.
 - m. Notation of coordination requirements.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Include the following information, as applicable:



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- a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shopwork manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Design calculations.
 - j. Compliance with specified standards.
 - k. Notation of coordination requirements.
 - l. Notation of dimensions established by field measurement.
2. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least **8-1/2 by 11 inches (215 by 280 mm)** but no larger than **the bidding drawings size**, in pdf format uploaded to project website in the proper section and item location
- D. Coordination Drawings: Comply with requirements in Division 1 Section "Project Management and Coordination."
- E. Samples: Prepare physical units of materials or products, including the following:
1. Comply with requirements in Division 1 Section "Quality Requirements" for mockups.
 2. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 3. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from the same material to be used for the Work, cured and finished in manner specified, and physically identical with the product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 4. Preparation: Mount, display, or package Samples in manner specified to facilitate review of qualities indicated. Prepare Samples to match Architect's sample where so indicated. Attach label on unexposed side that includes the following:



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- a. Generic description of Sample.
 - b. Product name or name of manufacturer.
 - c. Sample source.
5. Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, provide the following:
- a. Size limitations.
 - b. Compliance with recognized standards.
 - c. Availability.
 - d. Delivery time.
6. Submit Samples for review of kind, color, pattern, and texture for a final check of these characteristics with other elements and for a comparison of these characteristics between final submittal and actual component as delivered and installed.
- a. If variation in color, pattern, texture, or other characteristic is inherent in the product represented by a Sample, submit at least three sets of paired units that show approximate limits of the variations.
 - b. Refer to individual Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
7. Number of Samples for Initial Selection: Submit two (2) full sets of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
8. Number of Samples for Verification: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a Project Record Sample.
- a. Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
9. Disposition: Maintain sets of approved Samples at Project site, or deliver to job site upon request for need by CM or Architect, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.



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- a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
 - b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- F. Product Schedule or List: The CM has prepared a Submittal Schedule indicating Bid Package, Spec Section and types of products required. Retain first paragraph below for projects with a construction manager.
- G. Schedule of Values: Comply with requirements in Division 1 Section "Payment Procedures."
- H. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
- 1. Name, address, and telephone number of entity performing subcontract or supplying products.
 - 2. Number and title of related Specification Section(s) covered by subcontract.
 - 3. Drawing number and detail references, as appropriate, covered by subcontract.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
- B. Construction Schedule (Item No., Description, Duration/Lead Time, Relationships): Subcontractor/Supplier provide to CM via email within 7 days or NTP/Contract receipt on form provided by CM or in Gant Form in a writable format approved by CM. CM submit to Architect or Owner 7 days following that in Gant Form.
- C. Subcontractor/Supplier Company information sheet: Subcontractor/Supplier provide to CM via email within 7 days or NTP/Contract receipt on form provided by CM.
- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements.



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- F. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- G. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements and, where required, is authorized for this specific Project.
- H. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements. Include evidence of manufacturing experience where required.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements.
- J. Material Test Reports (**Manged BY CM through Owner Allowance**): Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
- K. Preconstruction Test Reports (**BY OWNER**): Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements.
- L. Field Test Reports (**BY OWNER**): Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements.
- M. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- N. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment.
- O. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of



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loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

- P. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:
1. Preparation of substrates.
 2. Required substrate tolerances.
 3. Sequence of installation or erection.
 4. Required installation tolerances.
 5. Required adjustments.
 6. Recommendations for cleaning and protection.
- Q. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- R. Installer's Field Reports: Prepare written information installation, tests, inspections, etc.. Include the following, as applicable:
1. Name, address, and telephone number of the Company and Employee making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.



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5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items installer deems relevant and as indicated in individual Specification Sections.
- S. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- T. Material Safety Data Sheets: Submit information directly to CM. If submitted to Architect, Architect will review this information but will return it with no action taken.

PART 3 - EXECUTION

3.1 CONSTRUCTION MANAGER REVIEW

- A. General: **CM will not review submittals that do not bear the Subcontractors or Suppliers approval stamp and may return them without action.** Review each submittal and check for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

- A. General: **Architect will not review submittals that do not bear CM's & Sub or Supplier approval stamp and may return them without action.**
- B. Action Submittals: CM will submit to Architect and Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
1. Approved as Submitted, Approved as Noted, Revise and Resubmit.



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- C. Informational Submittals: CM will review and submit to Architect who will review each submittal and will not return it, or will reject and return it if it does not comply with requirements. Architect will forward each submittal to Owner's Representative for distribution to appropriate party.
- D. Submittals not required by the Contract Documents will not be reviewed and may be discarded.

3.3 ADDITIONAL INFORMATION ON SUBMITTAL REQUIREMENTS:

- 1) Identify each document, shop drawing and material and equipment list, etc., similar to the following: Note: To assure adequate clarity to the project delivery process The CM and Architect reserves the right to require additional submittal data on a specification item without an increase in cost to the owner.

Example: When no spec section included use description = CIP Concrete Mix Design
When spec section provided = Section 05 10 00 Structural Steel Shop Drawings
Section 22 40 00 Plumbing Fixtures Product Data

Special Warranties, Certificates, and Operation and Maintenance Manuals – 1 Digital and 1 Paper copy shall be submitted to the CM before final payment will be made

END OF SECTION 01 33 00

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection agencies and services.
- E. Control of installation.
- F. Mock-ups.
- G. Tolerances.
- H. Manufacturers' field services.
- I. Defect Assessment.

1.2 RELATED REQUIREMENTS

- A. Section 013000 - Administrative Requirements: Submittal procedures.
- B. Section 014216 - Definitions.
- C. Section 016000 - Product Requirements: Requirements for material and product quality.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit copies of report to Architect and to Contractor.
 - 1. Include:
 - a. Date issued.
 - b. Project title and number.
 - c. Name of inspector.
 - d. Date and time of sampling or inspection.
 - e. Identification of product and specifications section.
 - f. Location in the Project.
 - g. Type of test/inspection.
 - h. Date of test/inspection.
 - i. Results of test/inspection.
 - j. Compliance with Contract Documents.
 - k. When requested by Architect, provide interpretation of results.
- D. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.
 - 1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- E. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.
- F. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.
 - 1. Submit report in duplicate within 30 days of observation to Architect for information.
 - 2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

1.4 Quality Assurance

- A. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.5 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.6 Testing and Inspection Agencies and Services

- A. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspections.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.
- D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have work performed by persons qualified to produce required and specified quality.
- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2 MOCK-UPS

- A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.
- B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.
- C. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.
- D. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

- E. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
- F. Architect will use accepted mock-ups as a comparison standard for the remaining Work.
- G. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

3.4 TESTING AND INSPECTION

- A. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- B. Contractor Responsibilities:
 - 1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
 - 2. Cooperate with laboratory personnel, and provide access to the Work.
 - 3. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 4. Notify Architect and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.
 - 5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
 - 6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- C. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust, and balance equipment as applicable, and to initiate instructions when necessary.
- B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.6 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not complying with specified requirements.

END OF SECTION

SECTION 014216 - DEFINITIONS

PART 1 GENERAL

1.1 SUMMARY

- A. Other definitions are included in individual specification sections.

1.2 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION



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SECTION 01 51 00 - TEMPORARY FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary General Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes requirements for temporary facilities and controls, including temporary utilities, support facilities, and security and protection facilities.
- B. Temporary utilities include, but are not limited to, the following:
 - 1. Water service and distribution.
 - 2. Sanitary facilities, including toilets, wash facilities, and drinking-water facilities.
 - 3. Electric power service.
 - 4. Lighting.
 - 5. Heat/cooling and temporary environmental conditions
 - 6. Telephone service.
- C. Support facilities include, but are not limited to, the following:
 - 1. Project identification and temporary signs.
 - 2. Field offices.
 - 3. Protective barriers and security
 - 4. Fire protection
 - 5. Temporary roads
 - 6. Dewatering
 - 7. Waste disposal (trash)
 - 8. Storm-water, erosion control
- D. Related documents include the following:
 - 1. Conditions of the Contract.
 - 2. Division 00, 01, 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 3. Divisions 2 through 33 for temporary heat, ventilation, and humidity control requirements for products in those Sections.



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1.3 USE CHARGES

- A. General: Use charges are the cost or use charges for temporary facilities which are not chargeable to Owner or Architect and shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost, including, but not limited to, the following:

(THE OWNER WILL PAY FOR COST OF USAGE OF TEMPORARY ELECTRIC AND WATER) Overuse or Excessive use of owner provided utilities' will be grounds for termination of use and over-use will be charged!)

1. Owner's 3rd party construction forces.
 2. Occupants of Project, CM and CM Forces, Contractor and contractor forces.
 3. Architect.
 4. Testing agencies.
- B. Water Service: BP 22 Subcontractor is required to provide 2 temporary yard hydrants at a location close to the building pad as required and at a precise location as directed by the CM for use by all entities engaged in construction activities at the project site. Until such time as the CM directs the BP 22 Subcontractor to install said temp yard hydrant, all Subcontractors shall provide for their own water source (both potable and non-potable) as required to complete their scope of work.
- C. Telecommunication Services: Each subcontractor is responsible for their own telecommunication services. Every subcontractor will provide the CM with a list of names, job title, email address and phone numbers for all employees responsible for their scope of work and the respective duties of each employee. The CM will not provide phone, internet or fax services to any Subcontractor but will provide the service to Subcontractors for a charge of \$150.00/month for internet services. The CM will provide internet services for the CM's on-site team and the Architect and Owner are allowed to utilize the CM's telecommunication while on site with the assistance of the CM.
- D. Electric Power Service The Bid Package 26 Subcontractor shall hook-up 2 of the CM's Construction Trailers and make arrangements for all temporary power as required for construction of the project. The OWNER shall pay for electric power service use, for electricity used by all entities engaged in construction activities at Project site.
- E. Propane gas used for testing, start ups, construction related heating and space conditioning prior to final completion shall be provided for by the Bid Package 23 Subcontractor as required.
- F. Sewer: The CM has made arrangements for temporary sanitation facilities for the entire construction period. The permanent toilet facilities WILL NOT be permitted for use.

1.4 QUALITY ASSURANCE



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A. Regulations/

- A. Standards: Comply with ANSI A10.6, NECA's "Temporary Electrical Facilities," and NFPA 241.
 - 1. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
 - 2. Electric Service: Comply with AHJ Requirements and NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
 - 3. Building Code Regulations
 - 4. Health & Safety Regulations
 - 5. Utility Company Regulations
 - 6. Police, Fire Department & Rescue Squad Rules
 - 7. Environmental Protection Regulations
- B. Tests and Inspections: Subcontractors shall Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Notify the CM's Site Superintendent as well at least 24 hours in advance, but it is ultimately on the Subcontractor to notify all entities and ensure test are performed.

1.5 PROJECT CONDITIONS

- A. Temporary Use of Permanent/ existing Facilities: Subcontractor/Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.
- B. Conditions of Use: The following conditions apply to use of temporary services and facilities by all parties engaged in the Work:
 - 1. Keep temporary services and facilities clean and neat.
 - 2. Relocate temporary services and facilities as required by progress of the Work.
 - 3. Coordinate all work with the owner's field representative, as required, prior to taking action.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by the Architect. Provide materials suitable for use intended. If Specification Sections in paragraph below are not included in the Project, add requirements here.



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2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Field Offices for Subcontractor's: As Approved by the CM. Power consumption is to be metered and made payable back to Owner.
- C. Self-Contained Toilet Units/Project Dumpsters: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material. The CM will provide Project Dumpsters for Construction Debris. Overuse or use not as intended on toilet units or dumpsters will result in the damaging subcontractor's company being charged 30 days worth of use or the amount of the last months invoice from the dumpster or portable toilet servicing company on this project and the cost of repair or replacement of the unit(s) if damaged or defaced.
- D. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- F. First Aid Supplies: Comply with governing regulations. Bid Package 26 Subcontractor to discuss requirements of E. and F. in correlation with their Bid package requirements prior to commencing. All Subcontractors shall include this requirement for their scope of work. The CM's First Aid Supplies will not be used for or by any Subcontractors except in extreme cases.
- G. Fire Extinguishers: Provide hand-carried, portable UL-rated, class "A" fire extinguishers for temporary offices and similar spaces. In other locations provide hand-carried, portable, UL-rated, class "ABC" dry chemical extinguishers, 5# minimum or as needed or a combination of extinguishers of NFPA recommended classes for the exposures.
 - 1. Comply with NFPA 10 and 241 for classification, extinguishing agent and size required by location and class of fire exposure. Each Subcontractor shall be required to provide as their work commences in accordance with the above standards and CM Safety policies . Hot Work permits are to be issued by CM where/when required as requested by the Subcontractor at least 48 hours in advance of the work commencing.
- H. Email/Cell Phones/Phone Numbers: Each subcontractor company is required to provide at minimum to their Job Foreman/Site Superintendent a working email address, cell phone with answering machine/voice mail set-up and all pertinent email addresses, phone numbers of the Foreman and Project manager of the Subcontractor Company are



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to be given to CM as requested/needed. The email address and phone number shall be working at all times during construction 24/7 in case of emergencies. The subcontractor shall also make arrangements after completion of the project for communication availability of Subcontractor to the CM so that the CM or Owner may be contact them after the project for questions pertaining to warranty or warrantied operations. IF the CM has to manage a Subcontractors warranty item, which is defined as going back to the site after substantial completion to asses or identify a warranty item of the Subcontractor, the CM shall charge the Subcontractor \$1,000.00 per instance plus labor, equipment, materials and overhead and mark-up to the Subcontractor that is-in-turn payable on Net 30 terms from the postmark date of the invoice mailed via USPS to teh Subcontractors main office.

- I. Drinking Water/Waste Cans: It is the responsibility of each Subcontractor Company to provide drinking water in adequate supply to all of its employees while working on this project. It is the responsibility of each Subcontractor Company to provide Waste Cans of adequate number and size to provide for disposal of their waste on an hourly basis. This includes providing rolling dump carts to its employees to provide for the safe removal or trash, refuse, debris out of the building to the project dumpster.
- J. CM will Provide a min. of five (5) hard hats, high reflectivity vests, ear plugs and goggles/safety glasses to be made available to the Owner, Architect and visitors on the site during the construction period.
- K. Storage/Fabrication: It is the responsibility of each subcontractor to: a) provide for their own safe storage of combustibles while on site and if adequate storage space is not available on site the Subcontractor shall provide for the daily delivery and removal of combustibles. b) provide and remove all fabrication equipment and refuse from the fabrication process completed onsite to offsite locations and make the area to be like new or as it was prior to the fabrication work.
- L. **Subcontractors who forget proper PPE will be required to either purchase proper PPE from the CM for the cost of \$250.00 per person to use or leave the project site and return with proper PPE before starting work/being allowed onto the jobsite. Proper PPE are long pants, closed toed shoes, Hard Hat, Safety Glasses, High-Visibility Shirt/Jacket/Vest identifying the employees Company Name, ear plugs when required, and sleeved shirts (no cut-off shirts are allowed on site).**

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Facilities will be located where they will serve Project adequately and result in minimum interference with performance of the Work.



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3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Subcontractors will Engage appropriate local utility company to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
1. Arrange with utility company, and Owner for time when service can be interrupted, if necessary, to make connections for temporary services.
 2. Provide adequate capacity at each stage of construction. Before temporary utility is available, ALL Bid Package Subcontractors shall provide trucked-in or temporary services of utilities as required for the work with-in their scopes of work. Example, water truck as required for masonry work. Generator as required for electrical power consumption.
 3. Obtain easements to bring temporary utilities to Project site where Owner's easements cannot be used for that purpose.
- B. Sanitary Facilities: CM will Provide temporary toilets for use during construction. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility as provided by the supplier. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 2. Toilets: Install self-contained toilet units. Shield toilets to ensure privacy.
 3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
 - a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel when mandated by AHJ.
 4. Drinking-Water Facilities: ALL Subcontractors shall Provide adequate drinking water for their employees.
- C. Electric Power Service: BP 26 Subcontractor shall Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
1. Install electric power service underground, unless overhead service must be used.
 2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
 3. Connect temporary service to Owner's existing power source, as directed by electric company officials.



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- D. Electric Distribution: BP 26 Subcontractor shall Provide receptacle outlets adequate for connection of power tools and equipment.
1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
 2. Provide warning signs at power outlets other than 110 to 120 V.
 3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
 4. Provide metal conduit enclosures or boxes for wiring devices.
 5. Provide 4-gang outlets, spaced so **100-foot** extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
- E. Lighting: BP 26 Subcontractor shall Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 2. Install exterior-yard site lighting that will provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
- F. BP 26 Subcontractor shall not wait for the CM to direct such operations or systems being installed and must take it upon itself to stay up to date and communicate with the CM on when such temporary installations must be installed.
- G. Heating and Cooling: BP 23 Subcontractor shall Include an allowance as stated in BP 23 in their Base Bid to cover the work of Sections F and G that provides temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. This allowance will be used on a T&M basis (see Section 00 20 00 for more information on T&M). Select equipment that will provide for installed specified items that will not have a harmful effect on completed installations or elements being installed.
1. Maintain a minimum temperature of **65 deg F** in permanently enclosed portions of building for normal construction activities, and **65 deg F** for finishing activities and areas where finished Work has been installed.
 2. Use of facility environmental systems prior to substantial completion: The contractor **MAY NOT** utilize permanent facility HVAC systems for temporary construction.
- H. Ventilation and Humidity Control: BP 23 Subcontractor shall Provide temporary ventilation/humidity control as required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment matching that specified that will not have a harmful effect on completed installations or elements being installed. Coordinate



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ventilation/humidity requirements to produce ambient conditions required and minimize energy consumption.

- I. BP 23 Subcontractor shall not wait for the CM to direct such operations or systems being installed and must take it upon itself to stay up to date and communicate with the CM on when such temporary installations must be installed to maintain schedule.

***BP 22 , 23 and 26 Subcontractors are directed to coordinate with the CM for all temporary facility information in this section compared to that in the Bid packages/scopes of Work prior to commencing. ***

- J. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas or areas in use or being worked in by trades of which these items will adversely affect. The work outlined below is to be completed by the Subcontractor who is doing the work affecting others and any items installed under this part are to be removed by the Sub that installed.
1. Prior to commencing work, isolate the HVAC system in area where work is to be performed in accordance with approved coordination drawings.
 - a. Disconnect supply and return ductwork in work area from HVAC systems servicing occupied areas.
 - b. Maintain negative air pressure within work area using HEPA-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust-producing equipment. Isolate limited work within occupied areas using portable dust containment devices.
 3. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.
- K. Temporary Roads and Paved Areas: WHEN INCLUDED IN THE BID PACKAGES, Subcontractor shall Construct and maintain temporary roads and paved areas adequate to support loads and to withstand exposure to traffic during construction period. The plans will Locate temporary roads and paved areas in same location as permanent roads and paved areas. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations. The contractor shall take special care to assure off site clutter or mudding of streets is avoided. Comply with jurisdictional requirements for maintenance of streets and entrances.
1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
 2. Prepare sub-grade and install subbase and base for temporary roads and paved areas according to Division 31 Section "Earthwork."
 3. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt



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- base-course pavement before installation of final course according to Division 32 Section "Hot-Mix Asphalt Paving."
- L. Temporary Use of Permanent Roads, Paved Areas and Temp Roads/Entrances: Protect existing paved areas, sidewalks and roads from damage from deliveries or any other construction activities. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Cost of repairs of any existing areas damaged by the Subcontractor or any deliveries or other activities by anyone providing service to the Subcontractor shall be paid by the Subcontractor.
- M. Traffic Controls: The CM will maintain traffic controls where required unless written to be provided in Subcontractor Bid Packages. NOTE: All earthwork and utility Subcontractors are to include correct and proper traffic control when doing work at, near or on City, County, State or Federal roads, streets and highways.
- N. Parking: If able and included in the bidding documents, the CM will Provide temporary parking areas for construction personnel. Coordinate with Owner and other CM for use of existing parking areas or for designation of temporary parking areas. Maintain access for busses, staff, and public access. Restore any areas used for temporary parking to original condition upon completion of the work.
- O. Dewatering Facilities and Drains: All Subcontractors as Required shall Comply with requirements in applicable Division 31 Sections or as required and needed for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
 2. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
 3. Remove snow and ice as required to minimize accumulations.
- P. Project Identification and Temporary Signs: The BP 08A Sub shall provide and install all Project identification signage as directed by the CM as they see fit. This Subcontractor shall provide a temporary 8'x4' painted plywood construction sign identifying the project, the owner, the architect, the CM, and other items deemed appropriate by the Owner. The sign shall be placed in a prominent location near the entrance and maintained by the contractor for the duration of the project.
- Q. The BP 08A Sub or CM, when BP 08A General Trades is not part of the Bid Packages bidding, shall Install other signs where required to inform public and persons seeking entrance to Project and required for management of visitors, the public, and students as a part of the Contractors Safety Plan. Do not permit installation of unauthorized signs.
1. Prepare temporary signs to provide directional information to construction personnel and visitors.



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2. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
 3. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.
- R. Lifts and Hoists: All subcontractors shall provide facilities necessary for hoisting materials and personnel.
1. Truck Cranes and similar devices used for hoisting materials are considered “tools and equipment” and are not temporary facilities.
- S. Temporary Stairs: Until such time as permanent stairs are available, when required, each subcontractor shall provide their own means of egress/ingress to different levels of the project and site.
- T. Waste Disposal Facilities: The CM will provide temporary dumpsters for construction and ALL SUBCONTRACTORS are to comply with:
1. Containment of construction related waste, trash, containers, boxes, and other refuse is the responsibility of the Contractor. Provide waste-collection containers in sizes adequate to handle waste from construction operations. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste. Comply with but not only Division 1 Section "Execution Requirements" for progress cleaning requirements.
 2. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited. Retain paragraph above or paragraph and subparagraph below. Individual Project circumstances may require use of other construction aids and miscellaneous facilities, such as scaffolds, platforms, swing stages, ramps and bridges, incidental sheeting and shoring, and demolition waste chutes.

3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: All Subcontractors shall Provide as necessary protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that will minimize complaints from persons or firms near Project site.
- B. Temporary Erosion and Sedimentation Control: BP 31 Subcontractor shall provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings, and authorities having jurisdiction, whichever is more stringent.



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1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from the project site during the course of the project.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- C. Storm water Control/SWPPP: BP 31 Subcontractor shall provide, maintain and comply with erosion control and sedimentation requirements/SWPPP for the site during construction.
- D. Tree and Plant Protection: BP 31 Subcontractor shall Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from construction damage. **Protect tree root systems from damage, flooding, and erosion.** Refer to Summary of the work for other requirements.
- E. Pest Control: The CM shall Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials. If it is found that Subcontractors have not complied with other sections of the project documents that allowed for pests to enter the building, then the CM shall backcharge the offending sub the cost of required pest control. It is every Subcontractors responsibility to make sure that exterior doors and closures remain closed, and that their trash/refuse/debris is deposited correctly. This will negate the use of any pest control measures by the CM.
- F. Site Enclosure Fence: BP 08A Subcontractor or the CM when BP 08A General Trades is not part of the Bid Packages bidding, shall **Provide a Site Enclosure Fence as shown on the drawings. The plan will** Include a plan for construction personnel parking; staging and delivery of materials. Include temporary trailer parking for trades.
1. Before construction operations begin, install chain-link or approved safe barrier/ enclosure fence with lockable entrance gates. Locate where indicated, or enclose entire Project site or portion determined sufficient to accommodate construction operations. Install in a manner that will prevent people, dogs, and other animals from easily entering site except by entrance gates.
 2. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
 3. If necessary, provide a 2-gate system that is compatible with labor union requirements for shared operation.
 4. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide Owner with one set of keys.
- G. Security Enclosure and Lockup: BP 08A Subcontractor or CM when BP 08A General Trades is not part of the Bid Packages bidding, shall furnish and Install substantial temporary enclosure around partially completed areas of construction as required. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and



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similar violations of security when able. It is the Subcontractor's responsibility to secure an dlock-up there own materials, tools and equipment while on the Project Site. IT IS NOT the CM's responsibility to safely secure or protect from theft or damage the Subcontractors tools, equipment or material and the CM shall not be responsible for theft on site.

- H. Barricades, Warning Signs, and Lights: BP 08A Subcontractor or the CM when BP 08A General Trades is not part of the Bid Packages bidding, shall Comply with standards and code requirements for erecting structurally adequate barricades. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- I. Temporary Enclosures: BP 08A Subcontractor Or the CM when BP 08AGeneral Trades is not part of the Bid Packages bidding, shall Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Vertical Openings: Close openings of **25 sq. ft.** or less with plywood or similar materials.
 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
- J. Temporary Partitions (if required): BP 08A Subcontractor or the CM, when BP 08A General Trades is not part of the Bid Packages bidding, shall Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.
1. Construct dustproof partitions of not less than nominal **4-inch** studs, **5/8-inch** gypsum wallboard with joints taped on occupied side
 2. Insulate partitions to provide noise protection to occupied areas.
 3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 4. Protect air-handling equipment.
 5. Weather-strip openings.
- K. Temporary Fire Protection: All Subcontractors shall, until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities as directed by the CM of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.



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1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Field Offices: Class A stored-pressure water-type extinguishers.
 - b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
 - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
2. Store combustible materials in containers in fire-safe locations.
3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.4 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 1. Locate field offices, storage sheds, sanitary facilities, and other temporary construction and support facilities for easy access.
 2. Provide incombustible construction for offices, shops, and sheds located within construction area or within **30 feet** of building lines. Comply with NFPA 241.
 3. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Project Identification and Temporary Signs: BP 08A Subcontractor or the CM when BP 08A General Trades is not part of the Bid Packages bidding, shall furnish and install Project Signage as shown on plans. The sign will recognize the project, the owner, Architect, General contractor. Other signage is not permitted unless approved by the owner.



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- C. Common-Use Field Office: The CM will Provide an insulated, weather-tight, air-conditioned field office for their use only and it shall be kept clean and orderly and provide e-mail capability to be used by Owner and Architect and by permission only to Subcontractors.

3.5 MOISTURE AND MOLD CONTROL

- A. Subcontractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction and replace any materials with mold visible.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
 2. Protect stored and installed material from flowing or standing water.
 3. Keep porous and organic materials from coming into prolonged contact with concrete.
 4. Remove standing water from decks.
 5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
 2. Keep interior spaces reasonably clean and protected from water damage.
 3. Periodically collect and remove waste containing cellulose or other organic matter.
 4. Discard or replace water-damaged material.
 5. Do not install material that is wet.
 6. Discard, replace or clean stored or installed material that begins to grow mold.
 7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
 2. Use temporary HVAC system to control humidity.
 3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.
 - a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for **48** hours are considered defective.



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- b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record daily readings over a forty-eight hour period. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
- c. Remove materials that cannot be completely restored to their manufactured moisture level within **96** hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: The CM will Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses. Coordinate activities regarding temporary facilities with the owner's representative at each project meeting.
- B. Maintenance: CM will Maintain their provided facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements as well as each Subcontractor maintaining their provided facilities per their Bid Packages/scopes of Work.
 - 1. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.
- C. Termination and Removal: CM will Remove or direct Subcontractors to remove their temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division I Section "Closeout Procedures."

END OF SECTION 01 51 00

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. General product requirements.
- B. Re-use of existing products.
- C. Transportation, handling, storage and protection.
- D. Product option requirements.
- E. Substitution limitations.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2 RELATED REQUIREMENTS

- A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

1.3 SUBMITTALS

- A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.1 EXISTING PRODUCTS

- A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.
- B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.
- C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.2 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by Contract Documents.

2.3 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.4 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1 SUBSTITUTION LIMITATIONS

- A. See Section 012500 - Substitution Procedures.

3.2 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.3 STORAGE AND PROTECTION

- A. Provide protection of stored materials and products against theft, casualty, or deterioration.
- B. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.
- C. Store and protect products in accordance with manufacturers' instructions.
- D. Store with seals and labels intact and legible.
- E. Arrange storage of materials and products to allow for visual inspection for the purpose of determination of quantities, amounts, and unit counts.
- F. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.
- G. For exterior storage of fabricated products, place on sloped supports above ground.
- H. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- I. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- J. Comply with manufacturer's warranty conditions, if any.
- K. Do not store products directly on the ground.
- L. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- M. Prevent contact with material that may cause corrosion, discoloration, or staining.
- N. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- O. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION



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SECTION 01 77 00 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for project closeout, including but not limited to:
 1. Inspection procedures, Substantial and Final Completion.
 2. Project record document submittal.
 3. Operating and maintenance manual submittal.
 4. Submittal of Release of Liens and warranties.
 5. Final cleaning.
- B. Closeout requirements for specific construction activities are included in the appropriate Sections or shall be per the submittals provided showing products by each Subcontractor.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following. The Contractor shall list items that are incomplete in the request (Punch List).

Scheduling the Substantial Completion Inspection:

1. Schedule the Substantial Completion Inspection for a time that the work for all Bid and Construction Packages can be observed at one inspection date and, should a follow up inspection be needed to verify punch list compliance, schedule that second inspection to occur at one inspection date unless otherwise agreed. One Certificate of Substantial Completion will be issued for the project.
2. Provide a schedule or written documentation for when the Punch list items will be complete. Work shall not exceed 45 calendar days.
3. Advise Owner of pending insurance and utility change-over requirements.
4. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.
5. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.



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6. Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Submit test/adjust/balance records. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
7. Complete final clean up requirements, including touch-up painting. Touch-up and otherwise repair and restore marred exposed finishes.

UPON THE FIRST PUNCH LIST BEING COMPLETED BY ARCHITECT AND/OR OWNER, (NOT COMPLETED BY CONTRACTORS) THIS SHALL CONSTITUTE SUBSTANTIAL COMPLETION AND THE ARCHITECT SHALL ISSUE A DOCUMENT PROCLAIMING SUCH TIME/MILESTONE. FURTHERMORE, THE ARCHITECT AND/OR OWNER SHALL NOT MAKE MULTIPLE LISTS OF DEFICIENCIES OR PUNCH LISTS DUE TO THEIR INABILITY TO REVIEW PROPERLY DURING THE FIRST PUNCH LIST. IN CASES WHEN ITEMS ARE APPARENTLY NOT COMPLETE AND NOT INCLUDED IN THE INITIAL PUNCH LIST, THE CONTRACTORS WILL REPAIR TO THE STANDARDS OF THE PROJECT DOCUMENTS. THE CM SHALL BE PAID FOR ANY DAMAGE THAT THEY ARE DIRECTED TO REPAIR DONE AT ANY TIME BY THE ARCHITECT OR OWNER OR OWNER OR ARCHITECTS SUBS OR EMPLOYEES.

- B. **Observation Procedures:** On receipt of a request for inspection, the Architect will either proceed with inspection or advise the Contractor of unfilled requirements. The Architect will prepare the Certificate of Substantial Completion following the inspection, or advise the Contractor of construction that must be completed or corrected before the certificate will be issued. Work must be sufficiently complete that the Architect can certify the final Pay Application within 45 days.
1. Upon written statement from the Contractor that the Work is complete, the Architect will repeat the inspection and notification procedure.
 2. Results of the completed inspection will form the basis of requirements for final acceptance.
 3. Release of Retainage or portions thereof will not be approved without Owner approval or Consent of Surety.
 4. Release of retainage or portions thereof will be determined by a multiplier of two (2) applied to all remaining work not complete. Ex. Value = \$100.00; Held Value \$200.00
 5. Also see General and Supplementary General Conditions requirements.

1.4 FINAL ACCEPTANCE

- A. **Preliminary Procedures:** Before requesting final inspection for certification of final acceptance and payment, complete the following. List exceptions in the request. (See Supplementary General Conditions also.)
1. Submit the final payment request with releases and supporting documentation not



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- previously submitted and accepted. Include certificates of insurance for products and completed operations where required.
2. Submit a copy of the Substantial Completion inspection list of items to be completed or corrected (punch list), stating that each item has been completed or otherwise resolved for acceptance, and the list has been endorsed and dated by the Architect.
 4. Submit warranties.
 5. **Submit consent of surety to final payment if required.**
 6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 3. Submit All Closeout Documents , record drawings, maintenance manuals, final project photographs, damage or settlement survey, property survey, and similar final record information.
 8. Submit All Affidavits, Prevailing Wage Final Reports etc.
 9. UPON FINAL PAYMENT FROM OWNER Submit Final Lien waivers.

B. ARCHITECT'S INSPECTION SUMMARY

1. **Architect will conduct one (1) inspection at notification for Substantial Completion.**
2. **Architect will conduct only one (1) re- inspection, for determining Substantial Completion.**
3. **Architect will conduct one (1) inspection for Final Completion.**
4. **Any additional inspections for Substantial Completion, partial completion inspections, or Final Completion will be at the cost of the Subcontractor(s) that is/are incomplete and has delayed Final Completion.**

1.5 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. The CM initiates the Punch List and provides it to the Architect, prior to the Inspection for Substantial Completion. The Architect will amend the List as a part of the Inspection process.
- B. Preparation: CM: Submit electronically one copy of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
 1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:



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- a. Project name.
- b. Date.
- c. Name of Architect.
- d. Name of Contractor/CM.
- e. Page number.

1.6 RECORD DOCUMENT SUBMITTALS

- A. General: Do not use record documents for construction purposes; protect from deterioration and loss in a secure, fire-resistive location; provide access to record documents for the CM, Owner and Architect's reference during normal working hours.
- B. Record Drawings: 1 PAPER COPY of all Record Drawings, including As-Builts are to be delivered to the CM from the Subcontractor and one digital copy to be emailed and or uploaded to the project website.
Subcontractors are to maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings throughout construction and are to be made available to the CM, Architect or Owner upon request for review of compliance to this section and the contract documents. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date. In addition to these hard line documents; Make the documents and owner personnel available to assist the designers in preparing electronic As-Built documents.
 1. Mark record sets with red or blue erasable pen or pencil; use other colors to distinguish between variations in separate categories of the Work.
 2. Mark new information that is important to the Owner, but was not shown on Contract Drawings or Shop Drawings.
 3. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates and other identification on the cover of each set.
 4. **AS-BUILT DRAWINGS ARE TO BE MAINTAINED DAILY BY EACH SUBCONTRACTOR.** If a Subcontractor is found to not be maintaining as-built documentation the CM shall have the authority to hire a registered engineer in the discipline of the non-compliant scope of work to provide the documentation and back charge the subcontractors contract the cost of the engineer having to provide as-built drawings/documentation.
- C. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders



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and modifications issued in printed form during construction. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation. Note related record drawing information and Product Data.

1. Upon completion of the Work, submit record Specifications to the Architect for the Owner's records.
- D. Record Product Data: Provide one copy of each Product Data submittal. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation. Note related Change Orders and mark-up of record drawings and Specifications.
1. Upon completion of mark-up, submit complete set of record Product Data to the Architect for the Owner's records.
- E. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Architect and the Owner's personnel to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- F. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for continued use and reference. Submit to the Architect for the Owner's records.
- G. Maintenance Manuals: 1 PAPER COPY to be delivered to the CM and one digital copy to be emailed and/or uploaded to the project website when in place. Organize operating and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual heavy-duty 2-inch, 3-ring vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder. Include the following types of information:
1. Emergency instructions.
 2. Spare parts list.
 3. Copies of warranties.
 4. Wiring diagrams.
 5. Recommended "turn around" cycles.
 6. Inspection procedures.
 7. Shop Drawings and Product Data.



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8. Fixture lamping schedule.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 CLOSEOUT PROCEDURES

A. Operating and Maintenance Instructions/OWNER TRAINING: Subcontractor shall arrange for each installer of its scope of works equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. PROVIDE VIDEO DOCUMENTATION OF TRAINING WITH CLOSEOUTS AND Include a detailed review, at minimum of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.

*** As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

1 PAPER COPY OF ALL REQUIRED CLOSEOUT DOCUMENTS is to be delivered by mail to the CM and one digital copy to be uploaded to project website when available.

3.2 FINAL CLEANING:



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- A. General: General cleaning during construction is required of all Subcontractors by the General Conditions and included in Section "Temporary Facilities" as well as Bid Packages/Scopes of Work.
- B. Cleaning: BP 08A Subcontractor or CM when the General Trades in not part of the bid package bidding, include but not limited to Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to the condition expected in a normal, commercial building cleaning and maintenance program. Comply with manufacturer's instructions.
1. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.
 - . Remove labels that are not permanent labels.
 - a. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compound and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
 - b. Clean exposed exterior and interior hard-surfaced finishes to a dust-free condition, free of stains, films and similar foreign substances. Restore reflective surfaces to their original reflective condition. Leave concrete floors broom clean. Vacuum carpeted surfaces.
 - c. Wipe surfaces of mechanical and electrical equipment. Remove excess lubrication and other substances. Clean plumbing fixtures to a sanitary condition. Clean light fixtures and lamps.
 - d. Clean the site, including landscape development areas, of rubbish, litter and other foreign substances. Sweep paved areas broom clean; remove stains, spills and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth even-textured surface.
- C. Removal of Protection: Installing Subcontractors shall Remove temporary protection and installing Subcontractors shall remove facilities installed for protection of the Work during construction.
- D. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
1. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION 01 77 00

SECTION 024100 - DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Selective demolition of building elements or structure for alteration purposes.

1.2 RELATED REQUIREMENTS

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 011000 - Summary: Description of items to be removed by Owner.
- C. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- D. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- E. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- F. Section 311000 - Site Clearing: For site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations 2022, with Errata (2021).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.5 CLOSEOUT SUBMITTALS

- A. Inventory of items that have been removed and salvaged.

1.6 FIELD CONDITIONS

- A. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- B. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- C. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

PART 3 EXECUTION

2.1 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with other requirements specified in Section 017000.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
 - 5. Provide, erect, and maintain temporary barriers and security devices.
 - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
 - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 8. Do not close or obstruct roadways or sidewalks without permit.
 - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

- 10. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Protect existing structures and other elements that are not to be removed.
 - 1. Provide bracing and shoring.
 - 2. Prevent movement or settlement of adjacent structures.
 - 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

2.2 SELECTIVE DEMOLITION FOR ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
 - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - 3. Verify that abandoned services serve only abandoned facilities before removal.
 - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.

2.3 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Footings.
 - 2. Foundation walls.
 - 3. Slabs-on-grade.
 - 4. Suspended slabs.
- B. Related Sections:
 - 1. Section 312000 "Earth Moving" for drainage fill under slabs-on-grade.
 - 2. Section 321313 "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

- D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.
 - 1. Location of construction joints is subject to approval of the Architect.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Form materials and form-release agents.
 - 4. Steel reinforcement and accessories.
 - 5. Fiber reinforcement.
 - 6. Waterstops.
 - 7. Curing compounds.
 - 8. Floor and slab treatments.
 - 9. Bonding agents.
 - 10. Adhesives.
 - 11. Vapor retarders.
 - 12. Semirigid joint filler.
 - 13. Joint-filler strips.
 - 14. Repair materials.
- B. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- C. Floor surface flatness and levelness measurements indicating compliance with specified tolerances.
- D. Field quality-control reports.
- E. Minutes of preinstallation conference.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- D. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
- E. Preinstallation Conference: Conduct conference at Project site.
 - 1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.
 - d. Concrete subcontractor.
 - e. Special concrete finish subcontractor.
 - 2. Review special inspection and testing and inspecting agency procedures for field quality control, concrete finishes and finishing, cold- and hot-weather concreting procedures, curing procedures, construction contraction and isolation joints, and joint-filler strips, semirigid joint fillers, forms and form removal limitations, [vapor-retarder installation, anchor rod and anchorage device installation tolerances, steel reinforcement installation, floor and slab flatness and levelness measurement, concrete repair procedures, and concrete protection.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
- B. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.

2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. High-density overlay, Class 1 or better.
 - b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
 - c. Structural 1, B-B or better; mill oiled and edge sealed.
 - d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

- B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

- D. Pan-Type Forms: Glass-fiber-reinforced plastic or formed steel, stiffened to resist plastic concrete loads without detrimental deformation.

- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.

- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.

- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

- H. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
 2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
 3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
- C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

- D. Deformed-Steel Wire: ASTM A 496/A 496M.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded Wire Reinforcement: ASTM A 497/A 497M, flat sheet.

2.3 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
 - 3. For zinc-coated reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
 - a. Fly Ash: ASTM C 618, Class F or C.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Silica Fume: ASTM C 1240, amorphous silica.
- C. Normal-Weight Aggregates: ASTM C 33 coarse aggregate or better, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal, typical. 3/8" nominal at elevated slabs on metal deck.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- D. Water: ASTM C 94/C 94M and potable.

2.5 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.

- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.6 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- H. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.8 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber.

- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized-steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- F. Dovetail Anchor Slots: Hot-dip galvanized-steel sheet, not less than 0.034 inch (0.85 mm) thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.

2.9 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch (3.2 mm) and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi (29 MPa) at 28 days when tested according to ASTM C 109/C 109M.
- B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch (6.4 mm) and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch (3.2 to 6 mm) or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi (34.5 MPa) at 28 days when tested according to ASTM C 109/C 109M.

2.10 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing, or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

- A. Footings: Refer to drawings.
- B. Foundation Walls: Refer to drawings.
- C. Slabs-on-Grade: Refer to drawings.
- D. Suspended Slabs: Refer to drawings.

2.12 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.13 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 - 1. For mixer capacity of 1 cu. yd. (0.76 cu. m) or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For mixer capacity larger than 1 cu. yd. (0.76 cu. m), increase mixing time by 15 seconds for each additional 1 cu. yd. (0.76 cu. m).
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Construct forms tight enough to prevent loss of concrete mortar.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.
- E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- G. Chamfer exterior corners and edges of permanently exposed concrete.
- H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.3 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder according to ASTM E 1643 and manufacturer's written instructions.
 - 1. Lap joints 6 inches (150 mm) and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
 - 1. Weld reinforcing bars according to AWS D1.4/D 1.4M, where indicated.
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

3.6 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
 - 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 2. Space vertical joints in walls at 2 times the wall height. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 - 3. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 - 4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness as follows:
 - 1. Grooved Joints for Exterior Slabs Only: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch (3.2 mm). Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - 2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- (3.2-mm-) wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
- D. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished concrete surface where joint sealants, specified in Section 079200 "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 2. Maintain reinforcement in position on chairs during concrete placement.
 3. Screed slab surfaces with a straightedge and strike off to correct elevations.

4. Slope surfaces uniformly to drains where required.
 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- F. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- G. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view.
- C. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete where indicated:
1. Smooth-Rubbed Finish: Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

2. Grout-Cleaned Finish: Wet concrete surfaces and apply grout of a consistency of thick paint to coat surfaces and fill small holes. Mix one part portland cement to one and one-half parts fine sand with a 1:1 mixture of bonding admixture and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap and keep surface damp by fog spray for at least 36 hours.
 3. Cork-Floated Finish: Wet concrete surfaces and apply a stiff grout. Mix one part portland cement and one part fine sand with a 1:1 mixture of bonding agent and water. Add white portland cement in amounts determined by trial patches so color of dry grout will match adjacent surfaces. Compress grout into voids by grinding surface. In a swirling motion, finish surface with a cork float.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.9 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraighening until surface is left with a uniform, smooth, granular texture.
1. Apply float finish to surfaces to receive trowel finish.
- C. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
1. Apply a trowel finish to surfaces indicated, exposed to view, or to be covered with flooring.
 2. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- (3.05-m-) long straightedge resting on two high spots and placed anywhere on the surface does not exceed **1/8 inch (3.2 mm)**.
- D. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated or exposed to weather. While concrete is still plastic, slightly scarify surface with a fine broom.
1. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- E. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and elsewhere as indicated.

1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

3.11 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.

- c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - c. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor covering used on Project.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.12 LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
 1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than 28 days old.
 3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
- B. Polished Concrete Floor Treatment: Apply polished concrete finish system to cured and prepared slabs to match accepted mockup.

1. Machine grind floor surfaces to receive polished finishes level and smooth.
 2. Apply penetrating liquid floor treatment for polished concrete in polishing sequence and according to manufacturer's written instructions, allowing recommended drying time between successive coats.
 3. Continue polishing with progressively finer grit diamond polishing pads to gloss level to match approved mockup.
 4. Control and dispose of waste products produced by grinding and polishing operations.
 5. Neutralize and clean polished floor surfaces.
- C. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.13 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least one month(s). Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches (50 mm) deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.14 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.

2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.15 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a special inspector to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Steel reinforcement placement.
 - 2. Steel reinforcement welding.
 - 3. Headed bolts and studs.
 - 4. Verification of use of required design mixture.
 - 5. Concrete placement, including conveying and depositing.
 - 6. Curing procedures and maintenance of curing temperature.
 - 7. Verification of concrete strength before removal of shores and forms from beams and slabs.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 - 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - 3. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 - 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 - 6. Unit Weight: ASTM C 567, fresh unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - 7. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
 - 8. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.

- a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
9. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
 10. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
 11. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
 12. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
 13. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.
 14. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 15. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.16 PROTECTION OF LIQUID FLOOR TREATMENTS

- A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 033000

SECTION 033511 - CONCRETE FLOOR FINISHES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface treatments for concrete floors and slabs.
 - 1. Polished Concrete
- B. Liquid densifiers and hardeners.
- C. Concrete stains and dyes.
- D. Polished concrete.
- E. Clear coatings.
- F. Clear penetrating sealers.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Finishing of concrete surface to tolerance; floating, troweling, and similar operations; curing.
- B. Section 033000 - Cast-in-Place Concrete: Curing compounds that also function as sealers.

1.3 REFERENCES

- A. ASTM 3363-05 Standard Test Method for Film Hardness by Pencil Test.
- B. ASTM D2047 Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull-Meter Method (Slip Coefficient).
- C. ASTM D523 standard test for Specular Gloss – Gloss Meter Reflectivity.
- D. ASTM E 430 Standard Method for Measurement of Gloss of High Gloss surfaces by Abridged Goniophotometry.
- E. ASTM E1155 Standard Test for Determining FF Floor Flatness and FL Floor Levelness Numbers.
- F. ACI 302.1R-89 American Concrete Institute Guide for Concrete Floor and Slab Construction.
- G. CPAA: Concrete Polishing Association of America.
- H. American Society of Concrete Contractors, Concrete Polishing Council.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with concrete floor placement and concrete floor curing.

1.5 PREINSTALLATION MEETING

- A. Conduct preinstallation conference at Project Site.
- B. Representatives to participate in a pre-construction conference at the project site to assure compliance with the requirements of this section. This pre-construction conference is to take place prior to establishing finish floor benchmark height for the building to coordinate installation construction sequence of concrete slab and initial floor grind as hand grinding edges near walls should be at a minimum.
- C. Discuss each step of grinding, honing, and polishing operations.
- D. Discuss the application of liquid applied products.
- E. Discuss protection of polished concrete floors before and after installation.

1.6 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data and installation instructions for concrete polishing system and finishing products, including manufacturer's installation instructions, information on compatibility of different products, and limitations.
- C. Maintenance Data: Provide data on maintenance and renewal of applied finishes. These instructions should contain precautions against cleaning products and methods that may be detrimental to finishes and performance.
- D. Samples for Initial Selection: For each type of product requiring color selection.
- E. Samples for verification: For each type of exposed color.

- F. Qualification Data: Provide written Installer's Certification documentation from the manufacturer confirming that installer meets the qualifications as specified and is eligible for manufacturer's warranty.
- G. Installer's Project References: Submit installers list of successfully completed polished concrete floor system projects, including project name and location, name of architect, and type and quantity of polished concrete floor system installed. Installer must provide a minimum list of ten successfully completed projects for verification of finished product(s).

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Use an experienced, approved, certified installer and adequate number of skilled workers who are trained and experienced in the work being performed.
 - 2. Provide a Letter of Certification from Product System manufacturer stating installer is a certified applicator of approved material and is equipped with necessary machinery needed for proper performance of work in this section.
 - 3. Contractor agrees to perform all work in accordance with the CPAA and will adhere to their standards and those specified herein.
- B. Protection:
 - 1. No satisfactory chemical or cleaning procedure is available to remove petroleum stains from concrete surfaces. Prevention is therefore essential.
 - a. All hydraulic powered equipment must be diapered to avoid staining the concrete.
 - b. No trade will park vehicles on the inside slab. If parking on the inside slab is necessary to complete their scope of work, drop cloths will be placed under vehicles at all times.
 - c. No pipe fitting machine will be used on the inside slab floor.
 - d. Steel will not be placed on interior slab to avoid rust staining.
 - e. Acids and acidic detergents will not come into contact with slab.
 - f. All trades informed that the slab must be protected at all times.
 - g. A janitorial-grade acrylic floor finish shall be applied to protect the slab from stains.

1.8 MOCK-UP

- A. Provide a mock-up area of polished concrete representative of specified process, exposure, surface, finish, color and joint design treatments.
- B. Mock-Up Size: 10 feet square by 4" thick.
- C. Locate where directed.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's sealed packaging, including application instructions.

1.10 FIELD CONDITIONS

- A. Maintain light level equivalent to a minimum 200 W light source at 8 feet above the floor surface over each 20 foot square area of floor being finished.
- B. Do not finish floors until interior heating system is operational.
- C. Maintain ambient temperature of 50 degrees F minimum.
- D. Concrete must be cured a minimum of 28 days.
- E. Comply with manufacturer's written instructions of substrate temperature, moisture content, ambient temperature, humidity, ventilation and other conditions affecting process.
 - 1. Alkalinity
 - a. Test Method: Measure pH according to method indicated in ASTM F710
 - b. Acceptable results: 8- 13.
 - 2. Moisture Vapor Transmission Rate:
 - a. Test Method: Perform anhydrous calcium chloride test according to ASTM F 1869.
 - b. Acceptable results: Not more than 5 pounds per 1000 square feet in 24 hours.
 - 3. Relative Humidity:

- a. Test Method: Perform relative humidity test using in-situ probes according to ASTM F 2170.
- b. Acceptable results: Not more than 75 percent.
- F. Inspect the existing substrate and document unsatisfactory conditions in writing. Verify that surfaces and site conditions are ready to receive work. Correct unacceptable conditions prior to installation of system. Commencement of work constitutes acceptance of substrate conditions.

1.11 WARRANTY

- A. Correct defective work within a two-year period commencing on the Date of Substantial Completion.
- B. Finish Warranty: Provide five-year manufacturer warranty against excessive degradation of finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
- C. See Section 017800 - Closeout Submittals for additional warranty requirements.
- D. Close areas to traffic during and after application for a time period recommended by the manufacturer.

PART 2 PRODUCTS

2.1 DENSIFIERS AND HARDENERS

- A. Pre- Densifier floor cleaner: As recommended by densifier manufacturer.
- B. Liquid Densifier/Hardener: Penetrating chemical compound that reacts with concrete, filling the pores and dustproofing; for application to concrete after set.
 - 1. The manufacturer's densifier must be hybrid or multi-silicate based. Concrete chemical densifier specifically for concrete surface treatment which reacts chemically to the concrete surface maintaining a clear, dense, durable, hard, abrasion and chemical resistant surface. Product shall be a solution that is less than 40 VOC.
 - a. Composition: Lithium silicate.
 - b. Products:
 - 1) PROSOCO, Inc; Consolideck LSGuard : www.prosoco.com/consolideck/#sle.

2.2 COATINGS

- A. Concrete Stain or Dye: Translucent, penetrating compound for interior or exterior use; must be finished with a topical sealer.
 - 1. Applied with Acetone. Water Based Not Allowed.
 - 2. Number of Coats: Minimum of two.
 - 3. Primary Color: As indicated in Drawings, in a formulation to match approved mock-up.
 - 4. Products:
 - a. PROSOCO, Inc; GemTone Stain: www.prosoco.com/consolideck/#sle.
- B. Stain Protector: Concrete chemical stain protector specifically for concrete surface treatment which reacts chemically to the concrete surface maintaining a clear, dense, durable, hard, abrasion and chemical resistant surface. Product shall be a solution that is less than 40 VOC.
- C. High Gloss Clear Coating: Transparent, nonyellowing, acrylic polymer-based coating.
 - 1. Composition: Solvent-based.
 - 2. Nonvolatile Content: 15 percent, minimum, when measured by volume.
 - 3. Products:
 - a. PROSOCO, Inc; Consolideck LSGuard: www.prosoco.com/consolideck/#sle.
- D. Penetrating Sealer: Transparent, nonyellowing, water- or solvent-based coating.
 - 1. Products:
 - a. Concrete Sealers USA: www.concretesealersusa.com/#sle.

2.3 POLISHED CONCRETE SYSTEM

- A. Polished Concrete System: Materials, equipment, and procedures designed and furnished by a single manufacturer to produce dense polished concrete of the specified sheen.

1. Basis of Design Product: Subject to compliance with requirements, provide complete solute-based polishing system by PROSOCO, Inc.; Consolideck Polished Concrete System or comparable product.

- a. PROSOCO, Inc; Consolideck Polished Concrete System:

www.prosoco.com/consolideck/#sle.

- B. Appearance: Provide Polished Concrete Appearance as indicated on Drawings with reference to American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Appearance Chart, PCAC-11.17.
- C. Aggregate Exposer: Expose aggregate with polishing installation as indicated on Drawings with reference to American Society of Concrete Contractors, Concrete Polishing Council, Polished Concrete Aggregate Exposure Chart, PCAEC-11.17.

2.4 EQUIPMENT

- A. Sprayer: Manufacturer approved high volume, low pressure sprayer and sprayer tip.
- B. Scrubber Machine used for cleaning operations shall have a head pressure of 150 lbs. or as required to produce the specified results.
- C. Field Grinding and Polishing Equipment: A multi-head, counter rotating, walk-behind or ride-on machine, of various size and weights, with diamond tooling affixed to the head for the purpose of grinding concrete. Excludes janitorial maintenance equipment.
 1. Use equipment capable of removing generated dust for dry grinding, honing or polishing.
 2. Use equipment capable of slurry extraction and containment for wet grinding, honing or polishing

2.5 ACCESSORIES

- A. Oil remediation system
- B. pH compatible detergent
- C. Repair material: A product that is designed to repair cracks and surface imperfections. The specified bonding materials shall have sufficient bonding to adhere after polishing process and to have abrasion resistance equal to or greater than adjacent substrate.
- D. Grout Material: A thin mortar used for filling voids such as a rapid set structural repair polymer or other material as recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that floor surfaces are acceptable to receive the work of this section.
- B. Verify that flaws in concrete have been patched and joints filled with methods and materials suitable for further finishes.
- C. Examine substrate for conditions affecting polishing process. Correct conditions detrimental to process.
- D. Verify that concrete floor flatness rating is at least 40. Notify the contractor if floor flatness rating not achieved. Do not proceed with installation until concrete floor flatness rating is achieved.

3.2 GENERAL

- A. Apply materials in accordance with manufacturer's instructions.
- B. Application is to take place at least 10 days prior to placement of furniture, fixtures and/or equipment, thus providing a complete, uninhibited concrete slab for application.
- C. Fill joints and saw cuts, repair spawled areas.
- D. Shave and level filled areas.
- E. Start any of the floor finish applications in presence of manufacturer's technical representative.

3.3 CLEANING

- A. Coordinate with joint filling operations. DO NOT perform wet cleaning within 72 hours prior to joint filling or per joint filler manufacturer's recommendations.
- B. Do not use stain or scuff removing agents on finished floor surface.
- C. Use non-oil based sweeping compound to control airborne dust.

- D. Treat oil spots with oil remediation system.
- E. Scrub floor with scrubber machine and appropriate brushes or pads and pH compatible detergent.

3.4 CLEANING FOR POLISH SYSTEM

- A. Clean floors as specified prior to polishing application.
- B. Polish floors as specified prior to application of densifier or stain protector.

3.5 COATING APPLICATION

- A. Verify that surface is free of previous coatings, sealers, curing compounds, water repellents, laitance, efflorescence, fats, oils, grease, wax, soluble salts, residues from cleaning agents, and other impediments to adhesion.
- B. Verify that water vapor emission from concrete and relative humidity in concrete are within limits established by coating manufacturer.
- C. Protect adjacent non-coated areas from drips, overflow, and overspray; immediately remove excess material.
- D. Apply coatings in accordance with manufacturer's instructions, matching approved mock-ups for color, special effects, sealing and workmanship.

3.6 CONCRETE POLISHING

- A. Execute using materials, equipment, and procedures specified by manufacturer, using manufacturer approved installer.
- B. Polished edge work of all areas shall be done with a 5" or 7" hand held or walk behind polishing tool.
- C. All grinding and polishing completed with grinder/polisher equipment connected to a dust collector.
- D. Protect finished surface as required and as recommended by manufacturer of polishing system.

END OF SECTION

SECTION 054000 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Load-bearing wall framing.
 - 2. Exterior non-load-bearing wall framing.
 - 3. Floor joist framing.
 - 4. Ceiling joist framing.
 - 5. Soffit framing.
- B. Related Requirements:
 - 1. Section 055000 "Metal Fabrications" for masonry shelf angles and connections.
 - 2. Section 092216 "Non-Structural Metal Framing" for interior non-load-bearing, metal-stud framing and ceiling-suspension assemblies.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cold-formed steel framing product and accessory.
- B. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- C. Delegated-Design Submittal: For cold-formed steel framing.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Welding certificates.
- C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Expansion anchors.
 - 3. Power-actuated anchors.
 - 4. Mechanical fasteners.
 - 5. Vertical deflection clips.
 - 6. Horizontal drift deflection clips
 - 7. Miscellaneous structural clips and accessories.
- D. Research Reports: For non-standard cold-formed steel framing, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

1.8 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

- a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft.
 - b. Exterior Non-Load-Bearing Framing Not Supporting Masonry Veneer: Horizontal deflection of 1/360 of the wall height.
 - c. Exterior Non-Load-Bearing Framing Supporting Full-Height Masonry Veneer: Horizontal deflection of 1/600 of the wall height.
 - d. Floor Joist Framing: Vertical deflection of 1/360 for live loads and 1/240 for total loads of the span.
 - e. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
- 3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
 - 4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 1 inch.
 - 5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Design Standards:
- 1. Floor and Roof Systems: AISI S210.
 - 2. Wall Studs: AISI S211.
 - 3. Headers: AISI S212.
 - 4. Lateral Design: AISI S213.
- D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.
- E. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

1.9 COLD-FORMED STEEL FRAMING, GENERAL

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating weight as follows:
- 1. Grade: As required by structural performance.
 - 2. Coating: G60.

1.10 LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. As required by design or indicated on plans.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with straight flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches (32 mm).
- C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as follows:
 - 1. As required by design or indicated on plans.

1.11 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
 - 2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
 - 2. Flange Width: 1-1/4 inches.
- C. Vertical Deflection Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: As required by design.
 - 2. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: As required by design.

- b. Flange Width: 1 inch (25 mm) plus the design gap for one-story structures.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: As required by design.
 - b. Flange Width: As required.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

1.12 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
- 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.
 - 3. Section Properties: As required by design.

1.13 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
- 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.
 - 3. Section Properties: As required by design.

1.14 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
- 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.
 - 3. Web stiffeners.
 - 4. Anchor clips.
 - 5. End clips.
 - 6. Foundation clips.
 - 7. Gusset plates.
 - 8. Stud kickers and knee braces.
 - 9. Joist hangers and end closures.
 - 10. Hole reinforcing plates.
 - 11. Backer plates.

1.15 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.
- C. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 - 1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

1.16 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: SSPC-Paint 20 or MIL-P-21035B.
- B. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.
- C. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, and plasticizing and water-reducing agents, complying with ASTM C 1107/C 1107M, with fluid consistency and 30-minute working time.
- D. Shims: Load bearing, high-density multimonomer plastic, and nonleaching; or of cold-formed steel of same grade and coating as framing members supported by shims.
- E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6.4 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members.

1.17 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 - 1. Fabricate framing assemblies using jigs or templates.
 - 2. Cut framing members by sawing or shearing; do not torch cut.

3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
 4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.
- C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:
1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 PREPARATION

- A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.
- B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

2.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
 - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 - 1. Cut framing members by sawing or shearing; do not torch cut.
 - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.
- J. Erection Tolerances: Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

2.4 LOAD-BEARING WALL INSTALLATION

- A. Install continuous top and bottom tracks sized to match studs. Align tracks accurately and securely anchor at corners and ends, and at spacings as follows:
 1. Anchor Spacing: To match stud spacing.
- B. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch (3 mm) between the end of wall framing member and the web of track. Fasten both flanges of studs to top and bottom tracks. Space studs as follows:
 1. Stud Spacing: As indicated.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.
- D. Align studs vertically where floor framing interrupts wall-framing continuity. Where studs cannot be aligned, continuously reinforce track to transfer loads.
- E. Align floor and roof framing over studs according to AISI S200, Section C1. Where framing cannot be aligned, continuously reinforce track to transfer loads.
- F. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.
- G. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
 1. Frame wall openings with not less than a double stud at each jamb of frame as indicated on Shop Drawings. Fasten jamb members together to uniformly distribute loads.
 2. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.
- H. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.
 1. If type of supplementary support is not indicated, comply with stud manufacturer's written recommendations and industry standards in each case, considering weight or load resulting from item supported.

- I. Install horizontal bridging in stud system, spaced vertically 48 inches. Fasten at each stud intersection.
 - 1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches (150 mm) deep.
 - 2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- J. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.
- K. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

2.5 EXTERIOR NON-LOAD-BEARING WALL INSTALLATION

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
- B. Fasten both flanges of studs to bottom track unless otherwise indicated. Space studs as follows:
 - 1. Stud Spacing: 16 inches.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer track to building structure.
 - 3. Connect vertical deflection clips to studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed metal framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

- a. Install solid blocking at centers indicated on Shop Drawings.
 - 2. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
 - 3. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 4. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

2.6 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Remove and replace work where test results indicate that it does not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

2.7 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 054000

SECTION 055000 - METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Shop fabricated steel and aluminum items, including:
- B. Metal ladders.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.

1.3 REFERENCE STANDARDS

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements 2008 (Reaffirmed 2018).
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates 2018.
- E. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength 2021.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.
- G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- I. ASTM B26/B26M - Standard Specification for Aluminum-Alloy Sand Castings 2018, with Editorial Revision.
- J. ASTM B85/B85M - Standard Specification for Aluminum-Alloy Die Castings 2018, with Editorial Revision.
- K. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- L. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- M. ASTM B210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes 2012.
- N. ASTM B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes (Metric) 2012.
- O. ASTM B211 - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire 2012.
- P. ASTM B211M - Standard Specification for Aluminum and Aluminum-Alloy Rolled or Cold-Finished Bar, Rod, and Wire (Metric) 2012.
- Q. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- R. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- S. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.
- T. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- U. AWS D1.2/D1.2M - Structural Welding Code - Aluminum 2014, with Errata (2020).
- V. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

- W. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.
- X. SSPC-SP 2 - Hand Tool Cleaning 2018.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's data sheets on each ladder safety system product to be used, including installation instructions.
- C. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1.5 QUALITY ASSURANCE

- A. Design Delegated under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in Design-Builder.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.
- C. Plates: ASTM A283/A283M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Slotted Channel Framing: ASTM A653/A653M, Grade 33.
- F. Slotted Channel Fittings: ASTM A1011/A1011M.
- G. Fasteners: _____.
- H. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.
- I. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- K. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- L. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M), 5052 alloy, H32 or H22 temper.
- C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210 (ASTM B210M), 6063 alloy, T6 temper.
- D. Aluminum-Alloy Bars: ASTM B211 (ASTM B211M), 6061 alloy, T6 temper.
- E. Aluminum-Alloy Sand Castings: ASTM B26/B26M.
- F. Aluminum-Alloy Die Castings: ASTM B85/B85M.
- G. Bolts, Nuts, and Washers: Stainless steel.
- H. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 PREFABRICATED LADDERS

- A. Prefabricated Ship Ladder: Welded metal unit complying with ANSI A14.3; factory fabricated to greatest degree practical and in the largest components possible.

1. Components: Manufacturer's standard rails, rungs, treads, handrails, returns, platforms and safety devices complying with the requirements of the MATERIALS article of this section.
2. Materials: Aluminum; ASTM B221 (ASTM B221M), 6063 alloy, T52 temper.
3. Incline: 60 degrees.
4. Finish: Mill finish aluminum.
5. Manufacturers:
 - a. O'Keeffe's Inc; Model 521A: www.okeeffes.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.

2.5 FINISHES - STEEL

- A. Prime paint steel items.
 1. Exceptions: Galvanize items to be embedded in concrete and items to be embedded in masonry.
 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.

2.6 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.
- B. Confirm that the ladder structure to which the ladder safety system is installed is capable of withstanding the loads applied by the system in the event of a fall.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.3 INSTALLATION

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Obtain approval prior to site cutting or making adjustments not scheduled.
- D. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall mounted handrails.
- B. Stair railings and guardrails.
- C. Free-standing railings at steps.

1.2 RELATED REQUIREMENTS

- A. Section 092116 - Gypsum Board Assemblies: Placement of backing plates in stud wall construction.
- B. Section 099113 - Exterior Painting: Paint finish.
- C. Section 099123 - Interior Painting: Paint finish.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.
- C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings 2021.
- E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings 2000 (Reapproved 2006).
- F. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer 2004.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1.5 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 50 pounds per linear foot applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935
- D. Allow for expansion and contraction of members and building movement without damage to connections or members.
- E. Dimensions: See drawings for configurations and heights.
 - 1. Top Rails and Wall Rails: 1-1/2 inches diameter, square.
 - 2. Intermediate Rails: 1-1/2 inches diameter, square.
 - 3. Posts: 1-1/2 inches diameter, square.
 - 4. Balusters: 1/2 inch square.
- F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to stud walls, provide backing plates, for bolting anchors.
 2. Posts: Provide adjustable flanged brackets.
- G. Provide welding fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

2.2 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.
- C. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 1. Exterior Components: Continuously seal joined pieces by continuous welds. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 2. Interior Components: Continuously seal joined pieces by continuous welds.
 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.
- F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION - 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Framing with dimensional lumber.
 - 2. Framing with engineered wood products.
 - 3. Wood blocking, and nailers.
 - 4. Wood furring.
 - 5. Plywood backing panels.

DEFINITIONS

- B. Dimension Lumber: Lumber of 2 inches nominal or greater but less than 5 inches nominal in least dimension.
- C. OSB: Oriented strand board.
- D. Timber: Lumber of 5 inches nominal size or greater in least dimension.
- E. Lumber grading agencies, and the abbreviations used to reference them, include the following:
 - 1. NeLMA: Northeastern Lumber Manufacturers' Association.
 - 2. NLGA: National Lumber Grades Authority.
 - 3. SPIB: The Southern Pine Inspection Bureau.
 - 4. WWPA: Western Wood Products Association.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D 5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.
 - 5. Include copies of warranties from chemical treatment manufacturers for each type of treatment.

1.3 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.
- B. Evaluation Reports: For the following, from ICC-ES:
 - 1. Wood-preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Engineered wood products.
 - 4. Power-driven fasteners.
 - 5. Powder-actuated fasteners.
 - 6. Expansion anchors.
 - 7. Post-installed anchors.
 - 8. Metal framing anchors.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber flat with spacers beneath and between each bundle to provide air circulation. Protect lumber from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

- A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry lumber.
 - 3. Provide dressed lumber, S4S, unless otherwise indicated.
- B. Maximum Moisture Content of Lumber: 15 percent for 2-inch nominal thickness or less, 19 percent for more than 2-inch nominal thickness unless otherwise indicated.
- C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

- A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground.
 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
- D. Application: Treat items indicated on Drawings, and the following:
 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 1. Blocking.
 2. Nailers.
 3. Furring.
- B. For items of dimension lumber size, provide Construction or No. 2 grade lumber and any of the following species:
 1. Mixed southern pine; SPIB.
 2. Hem-fir; WCLIB or WWPA.
 3. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 4. Western woods; WCLIB or WWPA.
- C. For concealed boards, provide lumber with 15 percent maximum moisture content and any of the following species and grades:

1. Mixed southern pine; No. 2 grade; SPIB.
 2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.
 4. Western woods; Construction or No. 2 Common grade; WCLIB or WWPA.
- D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.4 PLYWOOD BACKING PANELS

- A. Equipment Backing Panels: DOC PS 1, Exterior, AC, fire-retardant treated, in thickness indicated or, if not indicated, not less than 1/2-inch nominal thickness.

2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Bolts: Steel bolts complying with ASTM A 307, Grade A ; with ASTM A 563 hex nuts and, where indicated, flat washers.
- E. Expansion Anchors: Anchor bolt and sleeve assembly of material indicated below with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry assemblies and equal to four times the load imposed when installed in concrete as determined by testing per ASTM E 488 conducted by a qualified independent testing and inspecting agency.

2.6 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
 2. KC Metals Products, Inc.
 3. Phoenix Metal Products, Inc.
 4. Simpson Strong-Tie Co., Inc.
 5. USP Structural Connectors.
- C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.
1. Use for interior locations unless otherwise indicated.
- D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A 653/A 653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
1. Use for wood-preserved-treated lumber and where indicated.

2.7 MISCELLANEOUS MATERIALS

- A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.
- C. Adhesives for Gluing Furring and Sleepers to Concrete or Masonry: Formulation complying with ASTM D 3498 that is approved for use indicated by adhesive manufacturer.
- D. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.
- C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry to other construction; scribe and cope as needed for accurate fit. Locate nailers, blocking, and similar supports to comply with requirements for attaching other construction.
- D. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

- E. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant treated plywood backing panels with classification marking of testing agency exposed to view.
- F. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- G. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.
- H. Do not splice structural members between supports unless otherwise indicated.
- I. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- J. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
- K. Sort and select lumber so that natural characteristics will not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.
- L. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
- M. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- N. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. NES NER-272 for power-driven fasteners.
 - 2. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
- O. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.3 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.
- B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 061000

SECTION 061010 - NON-STRUCTURAL ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Miscellaneous framing and sheathing.
- B. Communications and electrical room mounting boards.
- C. Concealed wood blocking, nailers, and supports.
- D. Miscellaneous wood nailers, furring, and grounds.
- E. Wall sheathing with factory applied water-resistive and air barrier sheet.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM E2178 - Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials 2021a.
- D. ASTM E2357 - Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies 2018.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- G. AWPA U1 - Use Category System: User Specification for Treated Wood 2022.
- H. ICC-ES AC310 - Acceptance Criteria for Water-resistive Membranes Factory-bonded to Wood-based Structural Sheathing, Used as Water-Resistive Barriers 2008, with Editorial Revision (2015).
- I. PS 1 - Structural Plywood 2019.
- J. PS 2 - Performance Standard for Wood Structural Panels 2018.
- K. PS 20 - American Softwood Lumber Standard 2021.

1.4 SUBMITTALS

- A. Product Data: Provide technical data on non-structural wall sheathing.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation. Do not stack wood products in contact with ground.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Dimension Lumber: Comply with PS 20.
 - 1. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
 - 2. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.
- B. Lumber fabricated from old growth timber is not permitted.

2.2 DIMENSION LUMBER

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.

2.3 EXPOSED BOARDS

- A. Submit manufacturer's certificate that products meet or exceed specified requirements, in lieu of grade stamping.
- B. Moisture Content: Kiln-dry (15 percent maximum).
- C. Surfacing: S4S.
- D. Species: Southern Pine.
- E. Grade: No. 3, 3 Common, or Standard.

2.4 CONSTRUCTION PANELS

- A. Wall Sheathing: Plywood, PS 1, Grade C-D, Exposure I.
- B. Wall Sheathing: Glass mat faced gypsum with integral water-resistive and air barrier, ASTM C1177/C1177M, 5/8 inch thick.
 1. Edges: Square.
 2. Water Vapor Permeance: 6.78 perms, minimum, when tested in accordance with ASTM E96/E96M.
 3. Air Permeance, Sheathing: 0.004 cfm per square foot, maximum, when tested in accordance with ASTM E2178.
 4. Air Permeance, Assembly: 0.04 cfm per square foot, maximum, when tested in accordance with ASTM E2357.
 5. Fluid-Applied Flashing: Approved by sheathing manufacturer.
 6. Warranty:
 - a. Exposure: Manufacturer's standard; 12 months, against exposure damage, and dated from installation of product.
 - b. Defect: Manufacturer's standard; 5 years, against manufacturing defects, and dated from purchase of product.
 - c. Material: Manufacturer's standard; 5 years, dated from Date of Substantial Completion.
- C. Wall Sheathing: Oriented strand board structural wood panel with factory laminated water-resistive and air barrier layer.
 1. Sheathing Panel: PS 2, Exposure 1.
 - a. Size: 4 feet wide by 8 feet long.
 - b. Grade: Sheathing.
 - c. Performance Category: 5/8 PERF CAT.
 2. Integral Water-Resistive and Air Barrier: Sheet material qualifying as a Grade D water resistive barrier; complying with ICC-ES AC310.
 3. Water Vapor Permeance of Water Resistive and Air Barrier: 12 to 16 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure B.
 4. Maximum Allowable Air Leakage of Assembly, complying with ASTM E2357:
 - a. Infiltration: 0.0072 cfm per square foot, maximum, at a pressure differential of 1.57 pounds per square foot.
 - b. Exfiltration: 0.0023 cfm per square foot, maximum, at a pressure differential of 1.57 pounds per square foot.
 5. Provide fastening guide on top panel surface with separate markings indicating fastener spacing for 16 inches and 24 inches on center, respectively.
 6. Seam Tape: Manufacturer's standard pressure-sensitive, self-adhering, cold-applied, seam tape.
 7. Warranty: Manufacturer's standard 30 year limited system warranty of:
 - a. Performance: Panel and tape resistance to water penetration; tape adhesion.
 - b. Material: Free from manufacturing defects and panel delamination.

- D. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.5 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
 - 2. Anchors: Toggle bolt type for anchorage to hollow masonry.
- B. Die-Stamped Connectors: Hot dipped galvanized steel, sized to suit framing conditions.
 - 1. For contact with preservative treated wood in exposed locations, provide minimum G185 galvanizing complying with ASTM A653/A653M.

2.6 FACTORY WOOD TREATMENT

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
 - 1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
 - 2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWWA standards.
- B. Preservative Treatment:
 - 1. Preservative Pressure Treatment of Lumber Above Grade: AWWA U1, Use Category UC3B, Commodity Specification Ausing waterborne preservative.
 - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
 - b. Treat lumber exposed to weather.
 - c. Treat lumber in contact with masonry or concrete.
 - d. Treat lumber less than 18 inches above grade.
 - e. Treat lumber in other locations as indicated.
 - 2. Preservative Pressure Treatment of Plywood Above Grade: AWWA U1, Use Category UC2 and UC3B, Commodity Specification Fusing waterborne preservative.
 - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
 - b. Treat plywood in contact with masonry or concrete.
 - c. Treat plywood less than 18 inches above grade.
 - d. Treat plywood in other locations as indicated.
 - 3. Preservative Pressure Treatment of Lumber in Contact with Soil: AWWA U1, Use Category UC4A, Commodity Specification Ausing waterborne preservative.
 - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer of factory treatment chemicals for brush-application in the field.
 - b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

PART 3 EXECUTION

3.1 PREPARATION

- A. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.3 BLOCKING, NAILERS, AND SUPPORTS

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

- B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to code authorities may be used in lieu of solid wood blocking.
- C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.
- D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- F. Provide the following specific non-structural framing and blocking:
 - 1. Cabinets and shelf supports.
 - 2. Wall brackets.
 - 3. Handrails.
 - 4. Grab bars.
 - 5. Towel and bath accessories.
 - 6. Wall-mounted door stops.
 - 7. Chalkboards and marker boards.
 - 8. Wall paneling and trim.
 - 9. Joints of rigid wall coverings that occur between studs.
 - 10. Wall Mounted Televisions. .

3.4 INSTALLATION OF CONSTRUCTION PANELS

- A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using nails, screws, or staples.
- B. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches on center on all edges and into studs in field of board.
 - 1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
 - 2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
 - 3. Install adjacent boards without gaps.
- C. Wall Sheathing with Laminated Water-Resistive Barrier and Air Barrier: Secure to studs as recommended by manufacturer.
 - 1. Install with laminated water-resistive and air barrier on exterior side of sheathing.
 - 2. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
 - 3. Use only mechanically attached and drainable EIFS and exterior insulation with wall sheathing with laminated water-resistive and air barrier.
 - 4. Apply manufacturer's standard seam tape to joints between sheathing panels. Use tape gun or hard rubber roller as recommended by manufacturer.

3.5 CLEANING

- A. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- B. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 061500 - WOOD DECKING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plywood structural wood decking.

1.2 REFERENCE STANDARDS

- A. AITC 111 - Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection; 2005.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2017.
- C. PS 1 - Structural Plywood; 2009.
- D. AWPA P17 - Fire Retardant Formulations.
- E. AWPA P50 - Standard for Fire Retardant FR-2 (FR-2).

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials.
- C. Fire-Retardant Treatment Certification: Treating plant's certification of compliance with specified requirements.

1.4 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with at least three years of documented experience and certified by AITC.
- B. Fire-Retardant Treatment: Mark each piece of plywood and lumber to show compliance with specified standards.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glue laminated members in accordance with AITC 111 requirements for unwrapped material.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

PART 2 - PRODUCTS

2.1 WOOD MATERIALS

- A. Wood fabricated from old growth timber is not permitted.
- B. Regulatory Requirements:
 - 1. Comply with applicable code for fire retardant requirements.
- C. Marking: Mark each piece with producer's stamp indicating compliance with specified requirements; for pieces exposed to view in completed construction, submit manufacturer's certificate certifying that products comply with specified requirements in lieu of grade stamping.

2.2 ACCESSORIES

- A. Fasteners and Anchors:
 - 1. Fastener Type and Finish: Hot-dipped galvanized steel for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
- B. Adhesive: Waterproof, air cure type, cartridge dispensed.

2.3 FIRE RETARDANT PRESSURE TREATMENT OF PLYWOOD

- A. Fire retardant treatment for wood, including subflooring.
 - 1. Plywood: Comply with AWPA U1, UCFA, Type A.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that support framing is ready to receive decking.

3.2 PREPARATION

- A. Coordinate placement of bearing items.

3.3 INSTALLATION - PLYWOOD DECKING

- A. Install decking perpendicular to framing members with ends staggered over firm bearing.
- B. Engage plywood tongue and groove edges.
- C. Allow expansion space at edges and ends.
- D. Attach decking with adhesive and screws.
- E. Use sheathing clips at unsupported edges of plywood between supporting framing members.
- F. Cut decking to accommodate roof drain and flange.

3.4 TOLERANCES

- A. Surface Flatness of Decking Without Load: 1/4 inch in 10 feet maximum, and 1/2 inch in 30 feet maximum.

END OF SECTION

SECTION 062000 - FINISH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Finish carpentry items.

1.2 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Painting of finish carpentry items.

1.3 REFERENCE STANDARDS

- A. ANSI A135.4 - Basic Hardboard 2012 (Reaffirmed 2020).
- B. ANSI A208.1 - American National Standard for Particleboard 2022.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. AWI (QCP) - Quality Certification Program Current Edition.
- E. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition 2014, with Errata (2016).
- F. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards 2021, with Errata.
- G. AWPA U1 - Use Category System: User Specification for Treated Wood 2022.
- H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.
- I. PS 1 - Structural Plywood 2019.
- J. PS 20 - American Softwood Lumber Standard 2021.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 SUBMITTALS

- A. Product Data:
 - 1. Provide data on fire retardant treatment materials and application instructions.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
 - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.
- C. Samples: Submit two samples of wood trim 6 inch long.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation.
 - 1. Provide air circulation around stacks and under coverings.
 - 2. Protect materials from weather by covering with waterproof sheeting, securely anchored.

1.7 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness
- B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

PART 2 PRODUCTS

2.1 FINISH CARPENTRY ITEMS

- A. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.
- B. Interior Woodwork Items:
 - 1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.

2.2 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.3 SHEET MATERIALS

- A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
 - 1. Grading: Certified by the American Plywood Association.
- C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1 Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.
- D. Particleboard: ANSI A208.1 Composed of wood chips, sawdust, or flakes of medium density, made with waterproof resin binders; of grade to suit application; sanded faces.
- E. Hardboard: ANSI A135.4 Pressed wood fiber with resin binder, Class 1 - Tempered, 1/4 inch thick, smooth one side (S1S).

2.4 FASTENINGS

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

2.5 ACCESSORIES

- A. Lumber for Shimming and Blocking: Softwood lumber of indicated species.
- B. Cellular PVC Trim and Moldings: Extruded, expanded PVC; UV-resistant, heat-stabilized, and rigid material; for exterior use only.
 - 1. Density: 31 pounds per cubic foot, minimum.
 - 2. Flame Spread: ASTM E84, 75, maximum.
 - 3. Manufacturers:
 - a. AZEK Building Products, Inc: www.azek.com.
 - b. CertainTeed Corporation; www.certainteed.com.
 - c. Versatex Trimboard; a Wolfpac Technologies, Inc. company
 - d. Vi-Lux Plastics Inc; www.vi-lux.com.
- C. Aluminum Edge Trim: Extruded convex shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; natural mill finish.
- D. E. MDO Trim: Exterior Grade B-B MDO plywood.
- E. Primer: Alkyd primer sealer.
- F. Wood Filler: Solvent base, tinted to match surface finish color.

2.6 WOOD TREATMENT

- A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- C. Provide identification on fire retardant treated material.

2.7 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Shop prepare and identify components for book match grain matching during site erection.
- C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.8 SHOP FINISHING

- A. Apply wood filler in exposed nail and screw indentations.
- B. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:
 - 1. Transparent:

- a. System - 1, Lacquer, Nitrocellulose.
- b. Sheen: Flat.
- 2. Opaque:
 - a. System - 1, Lacquer, Nitrocellulose.
 - b. Color: As selected by Architect.
 - c. Sheen: Flat.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.2 INSTALLATION

- A. Set and secure materials and components in place, plumb and level.
- B. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- C. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

3.3 TOLERANCES

- A. Maximum Variation from True Position: 1/16 inch.
- B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch.

3.4 ADJUSTING

- A. Adjust joinery for uniform appearance.

3.5 CLEANING

- A. Touch up factory-applied finishes to restore damaged or soiled areas.

3.6 PROTECTION

- A. Protect installed products from damage from weather and other causes during construction.
- B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.
 - 1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 064100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Specially fabricated cabinet units.
- B. Hardware.
- C. Factory finishing.
- D. Preparation for installing utilities.

1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.
- B. Section 123600 - Countertops.

1.3 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. BHMA A156.9 - Cabinet Hardware 2020.
- C. NEMA LD 3 - High-Pressure Decorative Laminates 2005.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
- C. Product Data: Provide data for hardware accessories.
- D. Samples: Submit actual sample items of proposed pulls, hinges, and locksets, demonstrating hardware design, quality, and finish.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.

1.8 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1 CABINETS

- A. Quality Standard: Custom Grade
- B. Plastic Laminate Faced Cabinets: Custom grade.
- C. Cabinets at all locations:
 - 1. Finish - Exposed Exterior Surfaces: Decorative laminate.
 - 2. Finish - Exposed Interior Surfaces: Decorative laminate.
 - 3. Finish - Semi-Exposed Surfaces: Decorative laminate
 - 4. Finish - Concealed Surfaces: Manufacturer's option.
 - 5. Door and Drawer Front Edge Profiles: Square edge with thin applied band.
 - 6. Door and Drawer Front Retention Profiles: Fixed panel.
 - 7. Casework Construction Type: Type A - Frameless.
 - 8. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.
 - 9. Adjustable Shelf Loading: 40 psf.
 - a. Deflection: L/144.
 - 10. Cabinet Style: Flush overlay.
 - 11. Cabinet Doors and Drawer Fronts: Flush style.

2.2 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.3 Panel Core Materials

- A. Particleboard: Composite panel composed of cellulosic particles, additives, and bonding system; comply with ANSI A208.1.

2.4 LAMINATE MATERIALS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Formica Corporation: www.formica.com.
 - 2. Panolam Industries International, Inc; Nevamar: www.nevamar.com.
 - 3. Wilsonart: www.wilsonart.com/#sle.
 - 4. Pionite Decorative Surfaces: www.panolam.com/pionite
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Provide specific types as follows:
 - 1. Horizontal Surfaces: HGS, 0.048 inch nominal thickness, through color, colors as indicated, finish as indicated.
 - 2. Vertical Surfaces: VGS, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
 - 3. Post-Formed Horizontal Surfaces: HGP, 0.039 inch nominal thickness, through color, colors as indicated, finish as indicated.
 - 4. Post-Formed Vertical Surfaces: VGP, 0.028 inch nominal thickness, through color, colors as indicated, finish as indicated.
 - 5. Cabinet Liner: CLS, 0.020 inch nominal thickness, through color, color as selected, finish as indicated.
 - 6. Laminate Backer: BKL, 0.020 inch nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.5 ACCESSORIES

- A. Adhesive: Type recommended by fabricator to suit application.
- B. Plastic Edge Banding: Extruded PVC, flat shaped; smooth finish; self locking serrated tongue; of width to match component thickness.
 - 1. Color: As selected by Architect from manufacturer's standard range.
 - 2. Use at all exposed plywood edges.
 - 3. Use at all exposed shelf edges.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: Standard plastic grommets for cut-outs, in color verify color with Architect.

2.6 HARDWARE

- A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.
- B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.
- C. Fixed Specialty Shelf Supports:
 - 1. Material: Steel.
 - 2. Products:
 - a. A&M Hardware, Inc; Floating Brackets: <http://www.aandmhardware.com/#sle>.
 - b. A&M Hardware, Inc; Hidden Brackets: <http://www.aandmhardware.com/#sle>.
 - c. A&M Hardware, Inc; Concealed Flat Brackets:
<http://www.aandmhardware.com/#sle>.
- D. Countertop Support Brackets: Fixed, L-shaped, face-of-stud mounting.

1. Materials: Steel; T-shape cross-section.
 - a. Finish: Manufacturer's standard, factory-applied, powder coat.
 - b. Color: Black.
 2. Materials: Steel plates.
 3. Products:
 - a. A&M Hardware, Inc; Hybrid Brackets: www.aandmhardware.com/#sle.
 - b. A&M Hardware, Inc; Heavy-Duty Hybrid Brackets: www.aandmhardware.com/#sle.
 - E. Countertop Support Brackets: Fixed, L-shaped, face-of-partition mounting.
 1. Materials: Steel; T-shape cross-section.
 2. Materials: Aluminum sections.
 - a. Finish: Black powder coat.
 3. Products:
 - a. Rakks/Rangine Corporation; EH Series Brackets: www.rakks.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
 - F. Vanity Brackets: Fixed, ADA-compliant, face-of-stud mounting.
 1. Products:
 - a. A&M Hardware, Inc; ADA Vanity Brackets: www.aandmhardware.com/#sle.
 - G. Drawer and Door Pulls: See Casework Detail Drawings.
 - H. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with satin finish.
 - I. Drawer Systems: Integrated drawer slide and side.
 1. Side Type: Single wall.
 2. Drawer Side Height: 5-7/8 inches.
 3. Drawer Length: 18 inch.
 4. Extension Type: Standard extension.
 5. Static Load Capacity: Residential/Light Commercial grade.
 6. Mounting: Side mounted.
 7. Stops: Integral type.
 8. Features: Provide soft close self closing/stay closed and white epoxy finish with Traditional Roller Ball Drawer Slides type.
 - J. Hinges: European style concealed self-closing type, steel with satin finish.
 - K. Door and Drawer Silencers: BHMA A156.16, L03011.
- 2.7 FABRICATION**
- A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
 - B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.
 - C. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs.
 1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
 2. Cap exposed plastic laminate finish edges with material of same finish and pattern.
 - D. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
 1. Provide center matched panels at each elevation.
 2. Provide sequence matching across each elevation.
 3. Carry figure of cabinet fronts to toe kicks.
 - E. Mechanically fasten back splash to countertops as recommended by laminate manufacturer at 16 inches on center.

- F. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions.
Prime paint cut edges.

2.8 SHOP FINISHING

- A. Sand work smooth and set exposed nails and screws.
- B. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

- A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.
- B. Use fixture attachments in concealed locations for wall mounted components.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floor using appropriate angles and anchorages.
- F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.3 ADJUSTING

- A. Test installed work for rigidity and ability to support loads.
- B. Adjust moving or operating parts to function smoothly and correctly.

3.4 CLEANING

- A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 068316 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fiberglass reinforced plastic panels.

1.2 REFERENCE STANDARDS

- A. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fiberglass Reinforced Plastic Panels:
 - 1. Crane Composites, Inc: www.cranecomposites.com/#sle.
 - 2. Marlite, Inc: www.marlite.com/#sle.
 - 3. Nudo Products, Inc: www.nudo.com/#sle.
 - 4. Panolam Industries International, Inc: www.panolam.com/#sle.
 - 5. Substitutions: See Section 01 6000 - Product Requirements.

2.2 PANEL SYSTEMS

- A. Wall Panels Basis of Design: Inpro Sani-System Heavy Duty Wall Protection:
 - 1. Panel Size: 4 by 8 feet.
 - 2. Panel Thickness: 0.10 inch.
 - 3. Surface Design: Embossed.
 - 4. Color: White.
 - 5. Attachment Method: Adhesive only, sealant joints, no trim.

2.3 MATERIALS

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
 - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
- B. Sealant: Type recommended by panel manufacturer; white.

PART 3 EXECUTION

3.1 INSTALLATION - WALLS

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- G. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 071400 - FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fluid-Applied Waterproofing:
 - 1. Polyurethane waterproofing.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete substrate.
- B. Section 072100 - Thermal Insulation: Insulation used for protective cover.
- C. Section 079200 - Joint Sealants: Sealing moving joints in waterproofed surfaces that are not part of work in this section.

1.3 REFERENCE STANDARDS

- A. ASTM C836/C836M - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course 2018 (Reapproved 2022).
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- C. ASTM D746 - Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact 2020.
- D. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- E. ASTM D4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers 2022.
- F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- G. NRCA (WM) - The NRCA Waterproofing Manual 2021.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for membrane, surface conditioner, flexible flashings, joint cover sheet, and joint and crack sealants.
- C. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and acceptable installation temperatures.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.
- F. Warranty:
 - 1. Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 2. Submit installer's certification that installation complies with warranty conditions for the waterproofing membrane.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 MOCK-UP

- A. Construct mock-up consisting of 100 sq ft of horizontal waterproofed panel; to represent finished work including internal and external corners, drainage panel, base flashings, control joints, expansion joints, counterflashings, and protective cover.
- B. Mock-up may remain as part of this Work.

1.7 FIELD CONDITIONS

- A. Maintain ambient temperatures above 40 degrees F for 24 hours before and during application and until cured.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Contractor shall correct defective Work within a five year period after Date of Substantial Completion; remove and replace materials concealing waterproofing at no cost to Owner.
- C. Provide five year manufacturer warranty for waterproofing failing to resist penetration of water.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Polyurethane Waterproofing:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide BASF Construction Chemicals-Building Systems; MasterSeal HLM 5000: www.buildingsystems.basf.com or comparable product by one of the following:
 - a. Carlisle Coatings & Waterproofing, Inc: www.carlisleccw.com/#sle.
 - b. Gaco Western: www.gaco.com/#sle.
 - c. Karnak Corporation; ____: www.karnakcorp.com/#sle.
 - d. Tremco Commercial Sealants & Waterproofing; TREMproof 250GC: www.tremcosealants.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.

2.2 WATERPROOFING APPLICATIONS

- A. Polyurethane Waterproofing:
 - 1. Location: Foundation Walls/Footings.
 - 2. Cover with drainage panel.

2.3 FLUID APPLIED WATERPROOFING MATERIALS

- A. Polyurethane Waterproofing: Cold-applied one or two component polyurethane, complying with ASTM C836/C836M.
 - 1. Cured Thickness: 60 mils, 0.060 inch, minimum.
 - 2. Suitable for installation over concrete substrates.
 - 3. Tensile Strength: 400 psi, measured in accordance with ASTM D412.
 - 4. Ultimate Elongation: 180 percent, measured in accordance with ASTM D412.
 - 5. Durometer Hardness, Type A: 30, minimum, in accordance with ASTM D2240.
 - 6. Adhesion: Greater than 150 psi, measured in accordance with ASTM D4541.
 - 7. Brittleness Temperature: Based on minus 50 degrees F, measured in accordance with ASTM D746.

2.4 ACCESSORIES

- A. Sealant for Joints and Cracks in Substrate: Type compatible with waterproofing material and as recommended by waterproofing manufacturer.
- B. Drainage Panel: Drainage layer with geotextile filter fabric on earth side.
 - 1. Composition: Dimpled polyethylene core; polypropylene or polyester filter fabric.
 - 2. Thickness: 1/4 inch, minimum.
- C. Cant Strips: Premolded composition material.
- D. Counterflashings: As recommended by membrane and protection board manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify substrate surfaces are free of frozen matter, dampness, loose particles, cracks, pits, projections, penetrations, or foreign matter detrimental to adhesion or application of waterproofing system.
- C. Verify that substrate surfaces are smooth, free of honeycomb or pitting, and not detrimental to full contact bond of waterproofing materials.

- D. Verify items that penetrate surfaces to receive waterproofing are securely installed.

3.2 PREPARATION

- A. Protect adjacent surfaces from damage not designated to receive waterproofing.
- B. Clean and prepare surfaces to receive waterproofing in accordance with manufacturer's instructions.
- C. Do not apply waterproofing to surfaces unacceptable to waterproofing manufacturer.
- D. Fill non-moving joints and cracks with a filler compatible with waterproofing materials.
- E. Prepare building expansion joints at locations as indicated on drawings.
- F. Install cant strips at inside corners.

3.3 INSTALLATION

- A. Install waterproofing to specified minimum thickness in accordance with manufacturers instructions and NRCA (WM) applicable requirements.
- B. Seal membrane and flashings to adjoining surfaces.
 - 1. Install termination bar along edges.

3.4 INSTALLATION - DRAINAGE PANEL and PROTECTION BOARD

- A. Place drainage panel directly against membrane, butt joints, place to encourage drainage downward, and scribe and cut boards around projections, penetrations, and interruptions.

3.5 PROTECTION

- A. Do not permit traffic over unprotected or uncovered membrane.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Board insulation at perimeter foundation wall and underside of floor slabs.
- B. Batt insulation in exterior wall construction.
- C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation 2022.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- D. ASTM E136 - Standard Test Method for Assessing Combustibility of Materials Using a Vertical Tube Furnace at 750 °C 2022.
- E. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

1.6 FIELD CONDITIONS

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

- A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.
- B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.
- C. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene (XPS) Board Insulation Perimeter Foundation/Slab Installation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
 - 1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
 - 2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
 - 3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
 - 4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.

5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Products:
 - a. Dow Chemical Company: www.dowbuildingsolutions.com/#sle.
 - b. Kingspan Insulation LLC; GreenGuard XPS Type IV, 25 psi: www.kingspan.com/#sle.
 - c. Owens Corning Corporation; FOAMULAR Type ___ Extruded Polystyrene (XPS) Insulation: www.ocbuildingspec.com/#sle.
 - d. DiversiFoam Products; CertiFoam XPS: www.diversifoam.com

2.3 BATT INSULATION MATERIALS

- A. Glass Fiber Batt Insulation: Flexible preformed batt or blanket, complying with ASTM C665; friction fit.
 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E84.
 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E84.
 3. Combustibility: Non-combustible, when tested in accordance with ASTM E136, except for facing, if any.
 4. Products:
 - a. CertainTeed Corporation; <>: www.certainteed.com/#sle.
 - b. Johns Manville; <>: www.jm.com/#sle.
 - c. Owens Corning Corporation; EcoTouch PINK FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
 - d. Knauf Insulation.
 - e. Substitutions: See Section 016000 - Product Requirements.

2.4 ACCESSORIES

- A. Insulation for Miscellaneous Voids:
 1. Spray Polyurethane Foam Insulation: ASTM C 1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E 84.
- B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.
- C. Clean substrate of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

3.3 BOARD INSTALLATION AT FOUNDATION PERIMETER

- A. Install boards horizontally on foundation perimeter.
 1. Butt edges and ends tightly to adjacent boards and to protrusions.
- B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.4 BOARD INSTALLATION AT CONCRETE SLABS

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of 24 inches in from exterior walls.
 - 2. Place insulation under slabs on grade after base for slab has been compacted.
- C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.
- D. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.5 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall and ceiling spaces without gaps or voids. Do not compress insulation.
- C. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
- D. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
- E. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- F. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- G. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- H. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.6 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements for additional requirements.

3.7 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.
- B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION

SECTION 072500 - WEATHER BARRIERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 061000 - Rough Carpentry: Water-resistive barrier under exterior cladding.

1.3 DEFINITIONS

- A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.
- B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.
- C. Water Vapor Permeance: For purposes of conversion, $57.2 \text{ ng}/(\text{Pa s sq m}) = 1 \text{ perm}$.

1.4 REFERENCE STANDARDS

- A. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing 2017.
- B. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-- Tension 2016 (Reapproved 2021).
- C. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection 2021.
- D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- F. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components 2023.

1.5 PREINSTALLATION MEETINGS

- A. Pre-installation Conference: Conduct at Project Site.

1.6 SUBMITTALS

- A. Product Data: Provide data on material characteristics, performance criteria, and limitations.

1.7 QUALITY ASSURANCE

- A. A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.8 MOCK-UP

- A. Install air barrier materials in mock-up to set quality standards for materials and execution.
 - 1. Build integrated mockups of exterior wall assembly , 150 sq. ft., incorporating backup wall construction, external cladding, window, storefront, door frame and sill, insulation, ties and other penetrations, and flashing to demonstrate surface preparation, crack and joint treatment, application of air barriers, and sealing of gaps, terminations, and penetrations of air-barrier assembly.
 - a. Include junction with roofing membrane, building corner condition, and foundation wall intersection.

1.9 FIELD CONDITIONS

- A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

PART 2 PRODUCTS

2.1 WEATHER BARRIER ASSEMBLIES

- A. Air Barrier:
 - 1. On outside surface of sheathing of exterior walls use air barrier coating.
- 2.2 AIR BARRIER MATERIALS (WATER VAPOR PERMEABLE AND WATER-RESISTIVE)**
- A. Air Barrier, Fluid Applied: Vapor permeable, elastomeric waterproofing.
 - 1. Air Barrier Coating:
 - a. Air Permeance: 0.001 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
 - b. Water Vapor Permeance: 18 perms, minimum, when tested in accordance with ASTM E96/E96M, Procedure B.
 - c. Ultraviolet and Weathering Resistance: Approved in writing by manufacturer for up to 6 months of weather exposure after application.
 - d. Elongation: 300 percent, minimum, when tested in accordance with ASTM D412.
 - e. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.
 - f. Complies with NFPA 285 wall assembly requirements.
 - g. Nail Sealability: Pass, when tested in accordance with ASTM D1970/D1970M.
 - h. VOC Content: 100 g per L or less.
 - i. Sealants, Tapes and Accessories: As recommended by coating manufacturer.
 - j. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Carlisle Coatings & Waterproofing; Barrithane VP.
 - 2) DuPont Building Innovations; Tyvek Fluid Applied WB+ with Tyvek Fluid Applied Flashing and Joint Compound, Sealant for Tyvek Fluid Applied System and StraightFlash: www.dupont.com/#sle.
 - 3) Henry Company; Air-Bloc 17MR: www.henry.com/#sle.
 - 4) Parex USA, Inc; Parex USA WeatherSeal Trowel-on (with gauging aggregate): www.parexusa.com/#sle.
 - 5) Parex USA, Inc; Parex USA WeatherSeal Spray & Roll-on: www.parexusa.com/#sle.
 - 6) PROSOCO, Inc; R-GUARD Cat 5: www.prosoco.com/r-guard/#sle.
 - 7) PROSOCO, Inc; R-GUARD Spray Wrap MVP: www.prosoco.com/r-guard/#sle.
 - 8) Sto Corp; Sto Gold Coat: www.stocorp.com/#sle.
 - 9) Substitutions: See Section 016000 - Product Requirements.
- B. Glass-Mat Faced Air Barrier Gypsum Panel: Vapor permeable, and complies with physical property requirements of ASTM C1177/C1177M.
 - 1. Thickness: 5/8 inch.
 - 2. Width and Height: 48 inch wide by 96 inch high.
 - 3. Edges: Square.
 - 4. Air Permeance: 0.004 cubic feet per minute per square foot, maximum, when tested in accordance with ASTM E2178.
 - 5. Water Vapor Permeance: 6.78 perms, minimum, when tested in accordance with ASTM E96/E96M Procedure A (desiccant procedure).
 - 6. Water Penetration Resistance Around Nails: Pass, when tested in accordance with ASTM D1970/D1970M (modified).
 - 7. Surface Burning Characteristics: Flame spread index of 25 or less, smoke developed index of 450 or less (Class A), when tested in accordance with ASTM E84.
 - 8. Seam and Perimeter Tape: As recommended by sheet manufacturer.
 - 9. Manufacturers:
 - a. Tremco Commercial Sealants & Waterproofing; Securock ExoAir 430 Panel: www.tremcosealants.com/#sle.

- b. Georgia-Pacific; DensElement Barrier System.
- c. Substitutions: See Section 016000 - Product Requirements.

2.3 ACCESSORIES

- A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.
- B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M, except slip resistance requirement is waived if not installed on a roof.
 - 1. Composition: Any material that meets physical requirements of ASTM D1970/D1970M with exceptions indicated.
 - 2. Manufacturers:
 - a. DuPont Building Innovations; FlexWrap NF: www.dupont.com/#sle.
 - b. DuPont Building Innovations; StraightFlash: www.dupont.com/#sle.
 - c. DuPont Building Innovations; StraightFlash VF: www.dupont.com/#sle.
 - d. Fortifiber Building Systems Group; FortiFlash: www.fortifiber.com/#sle.
 - e. Fortifiber Building Systems Group; FortiFlash Commercial: www.fortifiber.com/#sle.
 - f. Fortifiber Building Systems Group; FortiFlex: www.fortifiber.com/#sle.
 - g. Fortifiber Building Systems Group; FortiFlash Butyl: www.fortifiber.com/#sle.
 - h. SIGA Cover Inc; SIGA-Wigluv: www.sigacover.com/#sle.
 - i. Substitutions: See Section 016000 - Product Requirements.
- C. Liquid Flashing: One part, fast curing, non-sag, elastomeric, gun grade, trowelable liquid flashing.
 - 1. Manufacturers:
 - a. BASF Corporation; MasterSeal AWB 900: www.master-builders-solutions.basf.us/#sle.
 - b. Master Wall Inc; SuperiorFlash: www.masterwall.com/#sle.
 - c. Pecora Corporation; _____: www.pecora.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- D. Stainless Steel Flashing: Flexible flashing with 8 mil, 0.008 inch thick sheet of Type 304 stainless steel, 8 mil, 0.008 inch of butyl adhesive and a siliconized release liner.
 - 1. Roll Length: 50 feet long.
 - 2. Width: 6 inch wide.
 - 3. Overlap joints at least 2 inch.
- E. Liquid Flashing: One part, fast curing, non-sag, gun grade, trowelable liquid flashing.
 - 1. Manufacturers:
 - a. Dow Chemical Company; DOWSIL 778 Silicone Liquid Flashing: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - b. Dow Chemical Company; DOWSIL 791 Silicone Weatherproofing Sealant: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
 - c. Momentive Performance Materials, Inc/GE Construction Sealants; Elemax 5000 Liquid-Applied Flashing: www.siliconeforbuilding.com/#sle.
 - d. Parex USA, Inc; Parex USA WeatherTECH with WeatherFlash: www.parexusa.com/#sle.
 - e. Polyglass USA, Inc; PolyFlash 1C One Part Flashing compound: www.polyglass.us/#sle.
 - f. Substitutions: See Section 016000 - Product Requirements.
- F. Termite-Resistant Barrier Seam and Window Flashing: Peel and stick flashing membrane; polyethylene film bonded to sealant.
 - 1. Thickness: 40 mil, 0.040 inch overall.
 - 2. Roll Width: 4 inch.

3. Manufacturers:
 - a. Polyguard Barrier Systems, Inc, a division of Polyguard Products, Inc; TERM Seam and Window Barrier: www.polyguardbarriers.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- G. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2 PREPARATION

- A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.
- B. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.

3.3 INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Air Barriers: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- D. Coatings:
 1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
 2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
 3. Use flashing to seal to adjacent construction and to bridge joints.
- E. Openings and Penetrations in Exterior Weather Barriers:
 1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
 2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
 3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
 4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
 5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
 6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.4 FIELD QUALITY CONTROL

- A. Do not cover installed weather barriers until required inspections have been completed.
- B. Take digital photographs of each portion of the installation prior to covering up.

3.5 PROTECTION

- A. Do not leave materials exposed to weather longer than recommended by manufacturer.

END OF SECTION

SECTION 076200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Sealants for joints within sheet metal fabrications.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- F. CDA A4050 - Copper in Architecture - Handbook current edition.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.

1.5 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- B. Samples: Submit two samples 6" by 6" inch in size illustrating metal finish color.
- C. Closeout
 - 1. Maintenance data.

1.6 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 5 years of documented experience.

1.7 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Finish Warranty Period: 20 years from date of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

- A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.
 - 1. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.
 - 2. Color: As selected by Architect from manufacturer's full colors.
- B. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.2 FABRICATION

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch and hemmed to form drip.
- G. Fabricate flashings to allow toe to extend 4" inches over roofing substrate. Return and brake edges.

2.3 ACCESSORIES

- A. Fasteners: Same material and finish as flashing metal, with soft neoprene washers.
- B. Primer: Zinc chromate type.
- C. Concealed Sealants: Non-curing butyl sealant.
- D. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.
- E. Plastic Cement: ASTM D4586/D4586M, Type I.
- F. Reglets: Surface mounted type, galvanized steel; face and ends covered with plastic tape.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.
- C. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3 INSTALLATION

- A. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.
- B. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted.
- C. Apply plastic cement compound between metal flashings and felt flashings.
- D. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- E. Seal metal joints watertight.

END OF SECTION

SECTION 077100 - ROOF SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufactured roof specialties, including copings and fascias.

1.2 RELATED REQUIREMENTS

- A. Section 077200 - Roof Accessories: Manufactured curbs, roof hatches, and snow guards.

1.3 REFERENCE STANDARDS

- A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix) 2022.
- B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems 2017.
- C. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free 2007 (Reapproved 2018).
- D. NRCA (RM) - The NRCA Roofing Manual 2023.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.
- C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.
- D. Samples: Submit two appropriately sized samples of coping.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Roof Edge Flashings and Copings:
 - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. ATAS International, Inc; Continuous Cleat Coping:
 - b. ATAS International, Inc; Drip Edge Fascia:
 - c. Metal-Era Inc:
 - d. Substitutions: See Section 016000 - Product Requirements.
 - 2. Roof Edge Flashings and Copings to be compliant with roof manufacturers roof warranty.

2.2 COMPONENTS

- A. Roof Edge Flashings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
 - 1. Configuration: Fascia, and edge securement for roof membrane.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
 - 3. Material: Formed steel sheet, galvanized, 24 gage, 0.024 inch thick, minimum.
 - 4. Finish: 70 percent polyvinylidene fluoride.
 - 5. Color: To be selected by Architect from manufacturer's full range.
- B. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.
 - 1. Configuration: Concealed hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
 - 2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
 - 3. Material: Formed steel sheet, galvanized, 24 gage, 0.024 inch thick, minimum.
 - 4. Finish: 70 percent polyvinylidene fluoride.

5. Color: To be selected by Architect from manufacturer's full range.

2.3 FINISHES

- A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.4 ACCESSORIES

- A. Sealant for Joints in Linear Components: As recommended by component manufacturer.
- B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.
- C. Roof Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.
 - 1. Refer to Section 077200 for information on roofing related accessories.

3.2 INSTALLATION

- A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.
- B. Seal joints within components when required by component manufacturer.
- C. Anchor components securely.
- D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.
- E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.
- F. Coordinate installation of flashing flanges into reglets.

END OF SECTION

SECTION 077200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Roof curbs.
- B. Equipment rails.
- C. Roof penetrations mounting curbs.
- D. Roof hatches, manual and automatic operation, including smoke vents.
- E. Non-penetrating pedestals.

1.2 RELATED REQUIREMENTS

- A. Section 077100 - Roof Specialties: Other manufactured roof specialty items.

1.3 REFERENCE STANDARDS

- A. 29 CFR 1910.23 - Ladders Current Edition.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- F. FM (AG) - FM Approval Guide Current Edition.
- G. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).
- H. UL (DIR) - Online Certifications Directory Current Edition.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used.
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. For smoke hatches, submit evidence of approval by evaluation agency specified.
- B. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
 - 1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
 - 2. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
- C. Certificate: For smoke hatches, provide certificate of approval from authority having jurisdiction.
- D. Closeout
 - 1. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.
- E. Warranty Documentation:
 - 1. Submit manufacturer warranty.
 - 2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
 - 3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store products under cover and elevated above grade.

1.6 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ROOF CURBS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. AES Industries Inc.
 - 2. The Pate Company
 - 3. LMCurbs; Roof Curbs
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
 - 1. Roof Curb Mounting Substrate: Curb substrate consists of corrugated metal roof deck with insulation.
 - 2. Sheet Metal Material:
 - 3. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33; G90 coating designation; 18 gage, 0.048 inch thick.
 - 4. Provide layouts and configurations indicated on drawings.
- C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of curb.
 - 2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
 - 3. Height Above Finished Roof Surface: 12" inches, minimum.
- D. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
 - 1. Provide preservative treated wood nailers along top of rails.
 - 2. Height Above Finished Roof Surface: 12" inches, minimum.
- E. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.
 - 1. Provide preservative treated wood nailers over entire top surface, for supports that are provided by others.
 - 2. Height Above Finished Roof Surface: 12" inches, minimum.

2.2 ROOF HATCHES AND VENTS

- A. Smoke and Heat Vent Manufacturers:
 - 1. Nystrom, Inc; SmokEscape (double leaf): www.nystrom.com/#sle.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Smoke and Heat Vents: Where "smoke" or "smoke/heat" operation is indicated, provide following additional features and omit manual operation for access.
 - 1. Smoke Release Mechanism: Automatic opening on melting of replaceable UL (DIR) listed fusible link at 165 degree F.
 - 2. UL (DIR) or FM (AG) listed as automatically operated smoke and heat vent.
 - 3. Fire Alarm Connection: Provide separate resettable electrical link release mechanism and connection point for fire alarm system.
 - 4. Size: As indicated on drawings.
- C. Frames and Curbs: One-piece curb and frame with integral cap flashing to receive roof flashings; extended bottom flange to suit mounting.
 - 1. Material: Stainless steel, Type 304, 14 gauge, 0.0747 inch thick.
 - 2. Insulation: Manufacturer's standard; 1 inch rigid glass fiber, located on inside hollow curb.

3. Curb Height: 12 inches from finished surface of roof, minimum.
- D. Safety Railing System: Roof hatch safety rail system mounted directly to curb without penetration of roofing system.
 1. Railing Size: As indicated on drawings.
 2. Railing: Comply with 29 CFR 1910.23 for ladder safety, with a safety factor of two.
 3. Posts and Rails: Aluminum tube.
 4. Gate: Same material as railing; automatic closing with latch.
 5. Finish: Manufacturer's standard, factory applied finish.
 6. Gate Hinges and Post Guides: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper aluminum.
 7. Mounting Brackets: Hot dipped galvanized steel, 1/4 inch thick, minimum.
 8. Fasteners: Stainless steel, Type 316.
 9. Basis of Design Product: Subject to compliance with requirements, provide BILCO Company (The); Bil-Guard 2.0 or a comparable product by one of the following:
 - a. Babcock-Davis.
 - b. Garlock Safety Systems
 - c. Substitutions: See Section 016000 - Product Requirements.
- E. Hardware: Type 316 stainless steel, unless otherwise indicated or required by manufacturer.
 1. Lifting Mechanisms: Compression or torsion spring operator with shock absorbers that automatically opens upon release of latch; capable of lifting covers despite 10 psf load.
 2. Hinges: Heavy duty pintle type.
 3. Hold open arm with vinyl-coated handle for manual release.
 4. Latch: Upon closing, engage latch automatically and reset manual release.
 5. Manual Release: Pull handle on interior.
 6. Smoke Hatches: Manual release operation not to disturb automatic release mechanisms; easy resetting by Owner's maintenance personnel; provide latch designed to prevent relatching unless automatic release mechanism has been properly reset for automatic operation.
 7. Locking: Padlock hasp on interior.

2.3 **NON-PENETRATING ROOFTOP SUPPORTS/ASSEMBLIES**

- A. Non-Penetrating Rooftop Support/Assemblies: Manufacturer-engineered and factory-fabricated, with pedestal bases that rest on top of roofing membrane, and not requiring any attachment to roof structure and not penetrating roofing assembly.
 1. Design Loadings and Configurations: As required by applicable codes.
 2. Height: Provide minimum clearance of 6 inches under supported items to top of roofing.
 3. Support Spacing and Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 4. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
 5. Hardware, Bolts, Nuts, and Washers: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A153/A153M.
 6. Products:
 - a. PHP Systems/Design; <>: www.phpsd.com/#sle.
- B. Pipe Supports: Provide attachment fixtures complying with MSS SP-58 and as indicated.
 1. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
 2. See relevant piping system specification section for additional requirements.
- C. Duct Supports: Provide extruded aluminum supports and sized in accordance with diameter of supported ducts, and with base that is non-penetrating of roofing membrane.
- D. Non-Penetrating Pedestals: Steel pedestals with square, round, or rectangular bases.

1. Bases: High density polypropylene.
2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4 CLEANING

- A. Clean installed work to like-new condition.

3.5 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 078400 - FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Firestopping of all joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 RELATED REQUIREMENTS

- A. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.3 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems 2015 (Reapproved 2019).
- C. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies 2013 (Reapproved 2017).
- D. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi 2015, with Editorial Revision (2021).
- E. ITS (DIR) - Directory of Listed Products Current Edition.
- F. FM (AG) - FM Approval Guide Current Edition.
- G. UL 1479 - Standard for Fire Tests of Penetration Firestops Current Edition, Including All Revisions.
- H. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems Current Edition, Including All Revisions.
- I. UL (DIR) - Online Certifications Directory Current Edition.
- J. UL (FRD) - Fire Resistance Directory Current Edition.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.5 SUBMITTALS

- A. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- B. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.6 QUALITY ASSURANCE

- A. Fire Testing: Provide firestopping assemblies of designs that provide the specified fire ratings when tested in accordance with methods indicated.
 - 1. Listing in UL (FRD) will be considered as constituting an acceptable test report.
 - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.
 - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- B. Installer Qualifications: Company specializing in performing the work of this section and:
 - 1. Trained by manufacturer.
 - 2. Verification of minimum three years documented experience installing work of this type.
 - 3. Verification of at least five satisfactorily completed projects of comparable size and type.

1.7 FIELD CONDITIONS

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Firestopping Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. 3M Fire Protection Products: www.3m.com/firestop.
 - 2. A/D Fire Protection Systems Inc: www.adfire.com.
 - 3. Hilti, Inc: www.us.hilti.com.
 - 4. Specified Technologies Inc: www.stifirestop.com.
 - 5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com.
 - 6. Thermafiber, Inc.: www.thermafiber.com.

2.2 MATERIALS

- A. Firestopping Materials: Any materials meeting requirements.
- B. Mold and Mildew Resistance: Provide firestopping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- D. Fire Ratings: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed. Refer to drawings for fire-resistance ratings.

2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS

- A. Head-of-Wall Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of floor or wall, whichever is greater.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
- B. Floor-to-Floor, Wall-to-Wall, and Wall-to-Floor Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
 - 1. Movement: Provide systems that have been tested to show movement capability as indicated.
 - 2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
 - 1. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.4 FIRESTOPPING SYSTEMS

- A. Firestopping: Penetrations in Fire-Resistance-Rated Walls.
 - 1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.
- B. Firestopping: Penetrations in Horizontal Assemblies.
 - 1. Fire Ratings: Use any system that is listed by UL (FRD) and tested in accordance with ASTM E814 or UL 1479 with F Rating of at least one hour, but not less than the fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

- B. Remove incompatible materials that could adversely affect bond.

3.3 INSTALLATION

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- C. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

- A. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

- A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

- A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 079200 - JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.

1.2 RELATED REQUIREMENTS

- A. Section 093000 - Tiling: Sealant between tile and plumbing fixtures and at junctions with other materials and changes in plane.

1.3 REFERENCE STANDARDS

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer 2015 (Reapproved 2022).
- B. ASTM C834 - Standard Specification for Latex Sealants 2017.
- C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications 2022.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- E. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants 2022.
- G. ASTM C1311 - Standard Specification for Solvent Release Sealants 2022.
- H. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness 2015 (Reapproved 2021).
- I. ASTM D412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension 2016 (Reapproved 2021).

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation conference: Conduct conference at Project Site.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Submit manufacturer's technical datasheets for each product to be used; include the following:
 - 1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
 - 2. List of backing materials approved for use with the specific product.
 - 3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
 - 4. Substrates the product should not be used on.
 - 5. Substrates for which use of primer is required.
 - 6. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
 - 7. Sample product warranty.
- C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.
- D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.
- E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

- B. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 JOINT SEALANT APPLICATIONS

- A. Scope:
 - 1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
 - a. Wall expansion and control joints.
 - b. Joints between door, window, and other frames and adjacent construction.
 - c. Joints between different exposed materials.
 - d. Openings below ledge angles in masonry.
 - e. Other joints indicated below.
 - 2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
 - a. Joints between door, window, and other frames and adjacent construction.
 - b. Other joints indicated below.
 - 3. Do not seal the following types of joints:
 - a. Intentional weep holes in masonry.
 - b. Joints indicated to be treated with manufactured expansion joint cover, or some other type of sealing device.
 - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
 - d. Joints where installation of sealant is specified in another section.
 - e. Joints between suspended panel ceilings/grid and walls.
- B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
 - 1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
 - 2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
 - 3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
- C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
 - 1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
 - 2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
 - 3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
 - 4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
 - 5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
 - 6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
 - 7. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, kitchens, food service areas, and food processing areas; fixtures in wet areas include plumbing fixtures, food service equipment, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.3 JOINT SEALANTS - GENERAL

- A. Colors: As selected by Architect from manufacturer's full range.

2.4 NONSAG JOINT SEALANTS

- A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses NT; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus 100 percent, minus 50 percent, minimum.
 2. Nonstaining to Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
 3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
 4. Hardness Range: 15 to 35, Shore A, when tested in accordance with ASTM C661.
 5. Color: To be selected by Architect from manufacturer's standard range.
 6. Cure Type: Single-component, neutral moisture curing.
 7. Service Temperature Range: minus 55 to 250 degrees F degrees F.
 8. Basis of Design Product: Subject to compliance with requirements, provide Dow Corning Corporation 790 Silicone Building Sealant or comparable product by one of the following:
 - a. Adfast USA Inc; Adseal LM 4600 Series: www.adfastcorp.com/#sle.
 - b. Adfast USA Inc; Adseal DWS 4580 Series: www.adfastcorp.com/#sle.
 - c. Dow Corning Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction.
 - d. Momentive Performance Materials, Inc/GE Silicones; SCS9000 SilPruf NB - Non-Staining Silicone Weatherproofing Sealant: www.siliconeforbuilding.com/#sle.
 - e. Pecora Corporation; <>: www.pecora.com/#sle.
 - f. Sika Corporation; Sikasil WS-290: www.usa-sika.com.
 - g. Sika Corporation; Sikasil 728NS: www.usa.sika.com/#sle.
 - h. Tremco Commercial Sealants & Waterproofing; Spectrem 1: www.tremcosealants.com/#sle.
 - i. Tremco Commercial Sealants & Waterproofing; Tremsil 200: www.tremcosealants.com/#sle.
 - j. Substitutions: See Section 016000 - Product Requirements.
- B. Polyurethane Sealant: ASTM C920, Grade NS, Uses NT; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 1 or comparable product by one of the following:
 - a. Pecora Corporation; DynaFlex: www.pecora.com/#sle.
 - b. Sika Corporation; Sikaflex-1a: www.usa.sika.com/#sle.
 - c. Sika Corporation; Sikaflex-15 LM: www.usa.sika.com/#sle.
 - d. Sika Corporation; Sikaflex-2c NS: www.usa.sika.com/#sle.
 - e. Tremco Commercial Sealants & Waterproofing; Dymonic 100: www.tremcosealants.com/#sle.
 - f. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: www.tremcosealants.com/#sle.
 - g. W. R. Meadows, Inc; POURTHANE NS: www.wrmeadows.com/#sle.
 - h. Substitutions: See Section 016000 - Product Requirements.
- C. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses A, M, T and NT; multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface .
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 20 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.

4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal NP 2 or comparable product by one of the following:
 - a. Sika Corporation: www.usa-sika.com.
 - b. Pecora Corporation: www.pecora.com.
 - c. Substitutions: See Section 016000 - Product Requirements.
- D. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 40 to 50, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
- E. Epoxy Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 65 to 75, Shore D, when tested in accordance with ASTM C661.
 2. Color: To be selected by Architect from manufacturer's standard range.
 3. Service Temperature Range: 40 to 120 degrees F.
 4. Products:
 - a. Pecora Corporation; DynaPoxy EP-1200 Two-Part Epoxy Security Sealant: www.pecora.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- F. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.
 2. Grade: ASTM C834; Grade 0 Degrees F (Minus 18 Degrees C).
 3. Products:
 - a. Everkem Diversified Products, Inc; EcoTex 25: www.everkemproducts.com/#sle.
 - b. Everkem Diversified Products, Inc; SilTex 40: www.everkemproducts.com/#sle.
 - c. Franklin International, Inc; Titebond GREENchoice Acoustical Smoke & Sound Sealant: www.titebond.com/#sle.
 - d. Franklin International, Inc; Titebond Painter's Plus Caulk: www.titebond.com/#sle.
 - e. Franklin International, Inc; Titebond Painter's Caulk: www.titebond.com/#sle.
 - f. Hilti, Inc; CP 506 Smoke and Acoustical Sealant: www.us.hilti.com/#sle.
 - g. Hilti, Inc; CP 572 Smoke and Acoustical Spray Sealant: www.us.hilti.com/#sle.
 - h. Hilti, Inc; Lightweight Smoke and Acoustic Sealant CS-S SA Light: www.us.hilti.com/#sle.
 - i. Master Builders Solutions; MasterSeal NP 520: www.master-builders-solutions.com/en-us/#sle.
 - j. Pecora Corporation; <>: www.pecora.com/#sle.
 - k. Tremco Commercial Sealants & Waterproofing; Tremflex 834: www.tremcosealants.com/#sle.
 - l. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound: www.tremcosealants.com/#sle.
 - m. Tremco Commercial Sealants & Waterproofing; Tremstop Smoke and Sound Spray: www.tremcosealants.com/#sle.
 - n. Substitutions: See Section 016000 - Product Requirements.
- G. Butyl Sealant: Rubber-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Hardness Range: 10 to 30, Shore A, when tested in accordance with ASTM C661.

2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 13 to 180 degrees F.
4. Basis of Design Product: Subject to compliance with requirements, provide Pecora Corporation; BC-158 or comparable product by one of the following:
 - a. Bostik, Inc.: www.bostik.com.

2.5 SELF-LEVELING JOINT SEALANTS

- A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Service Temperature Range: Minus 40 to 180 degrees F.
 5. Products:
 - a. Pecora Corporation; <>: www.pecora.com/#sle.
 - b. Sika Corporation; Sikaflex-1c SL: www.usa.sika.com/#sle.
 - c. Sika Corporation; Sikaflex-2c SL: www.usa.sika.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
 1. Movement Capability: Plus and minus 25 percent, minimum.
 2. Hardness Range: 30 to 35, Shore A, when tested in accordance with ASTM C661.
 3. Color: To be selected by Architect from manufacturer's standard range.
 4. Tensile Strength: 200 to 250 psi in accordance with ASTM D412.
 5. Products:
 - a. Pecora Corporation; DynaTrol II-SG (Slope Grade): www.pecora.com/#sle.
 - b. Pecora Corporation; Urexpan NR-200: www.pecora.com/#sle.
 - c. Tremco Commercial Sealants & Waterproofing; THC-901: www.tremcosealants.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
- C. Flexible Polyurethane Foam: Single-component, gun grade, and low-expanding.
 1. Products:
 - a. ADFAST Corporation; Adfoam Flex 1865: www.adfastcorp.com/#sle.
 - b. Adfast USA Inc; Adfoam Flex 1865: www.adfastcorp.com/#sle.
 - c. DAP Products Inc; DRAFTSTOP 812 Foam: www.dapspecline.com/#sle.
 - d. Tremco Commercial Sealants & Waterproofing; ExoAir Flex Foam: www.tremcosealants.com/#sle.
 - e. Tremco Commercial Sealants & Waterproofing; ExoAir LEF: www.tremcosealants.com/#sle.
 - f. Substitutions: See Section 016000 - Product Requirements.
- D. Semi-Rigid Self-Leveling Epoxy Joint Filler: Epoxy or epoxy/polyurethane copolymer; intended for filling cracks and control joints not subject to significant movement; rigid enough to support concrete edges under traffic.
 1. Composition: Multicomponent, 100 percent solids by weight.
 2. Durometer Hardness: Minimum of 85 for Type A or 35 for Type D, after seven days when tested in accordance with ASTM D2240.
 3. Color: To be selected by Architect from manufacturer's standard colors.
 4. Joint Width, Minimum: 1/8 inch.
 5. Joint Width, Maximum: 1/4 inch.

6. Joint Depth: Provide product suitable for joints from 1/8 inch to 2 inches in depth including space for backer rod.
7. Products:
 - a. Euclid Chemical Company; EUCO 700: www.euclidchemical.com/#sle.
 - b. Nox-Crete Inc; DynaFlex 502: www.nox-crete.com/#sle.
 - c. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.

2.6 ACCESSORIES

- A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
 1. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
 2. Basis of Design Product: Subject to compliance with requirements, provide BASF Corp. - Construction Chemicals; MasterSeal 920 & 921 or comparable product by one of the following:
 - a. Adfast USA Inc; Adseal BR-2600 Backer Rod: www.adfastcorp.com/#sle.
 - b. Nomaco, Inc: www.nomaco.com.
 - c. Alcot Plastics, Ltd.: www.alcotplastics.com
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, nonstaining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Noncorrosive and nonstaining type, type recommended by sealant manufacturer; compatible with joint forming materials.
- E. Primers: Type recommended by sealant manufacturer to suit application; nonstaining.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joints are ready to receive work.
- B. Verify that backing materials are compatible with sealants.
- C. Verify that backer rods are of the correct size.

3.2 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in an inconspicuous area to verify that it does not stain or discolor slab.

3.3 INSTALLATION

- A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Provide joint sealant installations complying with ASTM C1193.
- C. Install acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

- G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.
- I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

END OF SECTION

SECTION 079513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Expansion joint cover assemblies for floor, wall, ceiling, and soffit surfaces.

1.2 REFERENCE STANDARDS

- A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles 2020.
- D. ITS (DIR) - Directory of Listed Products Current Edition.
- E. UL (DIR) - Online Certifications Directory Current Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.4 SUBMITTALS

- A. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices, available colors and finish, and ____.
- B. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction, anchorage locations, and ____.
- C. Samples: Submit two samples ____ inch long, illustrating profile, dimension, color, and finish selected.
- D. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.
- E. Expansion Joint Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
 - 1. Manufacturer and model number for each expansion joint cover assembly.
 - 2. Expansion joint cover assembly cross-referenced to Drawings.
 - 3. Nominal, minimum, and maximum joint width.
 - 4. Movement direction.
 - 5. Materials, colors, and finishes.
 - 6. Product options.
 - 7. Fire-resistance ratings as applicable.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1.5 CLOSEOUT SUBMITTALS

- A. Owner's Manuals and Maintenance Instructions.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Expansion Joint Cover Assemblies:
 - 1. BASF Corporation - Watson Bowman Acme Corporation
 - 2. Inpro.
 - 3. Nystrom, Inc..

2.2 EXPANSION JOINT COVER ASSEMBLIES

- A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.
 - 1. Joint Dimensions and Configurations: As indicated on drawings.

2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.
 3. Joint Cover Styles: As indicated on drawings.
 4. Joint Movement Capability: If not indicated on drawings, provide minimum plus/minus 25 percent joint movement capability.
 5. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.
 6. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.
- B. Floor Joint Covers: Coordinate with indicated floor coverings.
1. If style is not indicated, provide extruded aluminum frame both sides, resilient seals, and minimize exposed metal.
- C. Resilient Seal Type Covers: Having flat exposed surface without crevices that could collect dirt; designed to withstand expected movement without extrusion of seal from joint assembly; for floors, provide style that is flush with top of floor covering; for exterior joints, weathertight.
- D. Sliding Cover Plate Type Covers: Provide plate with beveled edges and neat fit that does not collect dirt.
- E. Covers In Gypsum Board Assemblies: Provide style with anchoring wings that can be completely covered by joint compound.
- F. Covers In Fire Rated Assemblies: Provide cover assembly having fire rating equivalent to that of assembly into which it is installed.
1. Acceptable Evaluation Agencies: UL (DIR) and ITS (DIR).

2.3 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.
1. Exposed Finish Outdoors: Natural anodized.
 2. Exposed Finish at Floors: Mill finish or natural anodized.
 3. Exposed Finish at Walls and Ceilings: Natural anodized.
- B. Resilient Seals:
1. For Ceilings: Any resilient material, flush, pleated, or hollow gasket.
 2. For Pedestrian Traffic Applications: EPDM rubber, Neoprene, or Santoprene; no PVC; Shore A hardness of 40 to 50 Durometer.
 3. Color: Gray.
- C. Anchors and Fasteners: As recommended by cover manufacturer.
- D. Ferrous Metal Anchors: Galvanized where embedded in concrete or in contact with cementitious materials.
- E. Threaded Fasteners: Aluminum.
- F. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.
- G. Nonmetallic, shrinkage-resistant grout: ASTM C 1107/C 1107M, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

2.4 ACCESSORIES

- A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint. Provide as indicated on Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.
- B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.2 INSTALLATION

- A. Install components and accessories in accordance with manufacturer's instructions.
- B. Repair or grout block cores as required for continuous frame support using non-metallic, shrinkage resistant grout.
- C. Align work plumb and level, flush with adjacent surfaces.
- D. Rigidly anchor to substrate to prevent misalignment.
- E. Install frames in continuous contact with adjacent surfaces. The use of shims is not permitted.
- F. Install with hairline mitered corners where expansion joint cover assemblies change direction.
- G. Terminate exposed ends of expansion joint cover assemblies with factory-fabricated termination devices when offered by manufacturer. Terminate exposed ends with field-fabricated if manufacturer does not offer termination devices.

3.3 CONNECTIONS

- A. Transition Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with reof expansion joint covers as applicable. Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.

3.4 PROTECTION

- A. Do not permit traffic over unprotected floor joint surfaces.
- B. Provide strippable coating to protect finish surface.

END OF SECTION

SECTION 080671 - DOOR HARDWARE SCHEDULE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Preliminary schedule of door hardware sets for swinging as indicated on drawings.

1.2 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware: Requirements to comply with in coordination with this section.

1.3 REFERENCE STANDARDS

- A. BHMA (CPD) - Certified Products Directory Current Edition.
- B. BHMA A156.3 - Exit Devices 2020.
- C. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
- D. BHMA A156.13 - Mortise Locks & Latches Series 1000 2022.
- E. BHMA A156.18 - Materials and Finishes 2020.
- F. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Comply with submittal requirements as indicated in Section 087100.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Only manufacturers listed in Door Hardware Schedule or Section 087100 are considered acceptable, unless noted otherwise.
- B. Obtain each type of door hardware as indicated from a single manufacturer and single supplier.
- C. Products are listed and certified compliant with specified standards by BHMA (CPD).
- D. Manufacturer's Abbreviations: Coordinate with manufacturers listed in Section 087100.
 - 1. AR - Adams Rite.
 - 2. BAS - Best Access Systems.
 - 3. BOM - Bommer Industries.
 - 4. CR - Corbin Russwin.
 - 5. CRL - C. R. Laurence.
 - 6. CUR - Curries.
 - 7. DTX - Detex.
 - 8. DMA - Dorma.
 - 9. FC - Falcon.
 - 10. FOR - Forms+Surfaces.
 - 11. GJ - Glynn Johnson.
 - 12. HGR - Hager.
 - 13. HES - HES.
 - 14. HG - Hettich Grant.
 - 15. HIA - Hiawatha.
 - 16. IVE - Ives.
 - 17. JOH - Johnson Hardware.
 - 18. KNX - Knox Company.
 - 19. LCN - LCN.
 - 20. McK - McKinney.
 - 21. MED - Medeco.
 - 22. MKR - Markar.
 - 23. NGP - National Guard Products.
 - 24. NOR - Norton.
 - 25. PEM - Pemko.
 - 26. PH - Precision Hardware.

27. RIX - Rixson.
28. ROC - Rockwood.
29. SA - Sargent.
30. SCH - Schlage.
31. SEC - Securitron.
32. SDC - Stanley Door Closers.
33. SH - Stanley Hinges.
34. STH - Stanley Commercial Hardware.
35. TR - Trimco.
36. VD - Von Duprin.
37. YA - Yale.
38. ZRO - Zero Industries, Inc.

2.2 DESCRIPTION

- A. Door hardware sets provided represent the design intent, they are only a guideline and should not be considered a detailed or complete hardware schedule.
1. Provide door hardware item(s) as required for similar purposes, even when item is not listed for a door in Door Hardware Schedule.
 2. Necessary items that are not included in a Hardware Set should be added and have the appropriate additional hardware as required for proper application and functionality.
 3. Door hardware supplier is responsible for providing proper size and hand of door for products required in accordance with Door Hardware Schedule and as indicated on drawings.
 4. Quantities listed are for each Pair (PR) of doors, or for each Single (SGL) door, as indicated in hardware sets.

2.3 LOCK FUNCTION CODES

- A. Function Codes for Cylindrical Locks: Complying with BHMA A156.5.
1. Code F75; Passage: Latch retracted by knobs/levers at all times.
 2. Code F76; Privacy Lock: Outside knob/lever locked by pushbutton on inside knob/lever. Rotating inside knob/lever or closing door releases/unlocks button. Emergency release in outside knob/lever.
 3. Code F81; Office Lock: Turn button locking. Turning button on inside locks outside knob/lever until unlocked by key or by rotating the inside knob/lever. Inside knob/lever always free. Deadlocking latch bolt.
 4. Code F82; Entry Lock: Push button locking. Button on inside locks outside knob/lever until unlocked by key or by rotating the inside knob/lever. Inside knob/lever always free. Deadlocking latch bolt.
 5. Code F84; Classroom Lock: Outside knob/lever locked/unlocked by key in outside knob/lever. Inside knob/lever always free. Deadlocking latchbolt.
 6. Code F86; Storeroom Lock: Outside knob/lever always locked/rigid. Latchbolt retracted by key in outside knob/lever or by rotating inside knob/lever. Inside knob/lever always free. Deadlocking latchbolt.
 7. Code F90; Dormitory Lock: Deadlocking latch bolt by levers except when locked by push button in inside lever. Key in outside lever locks or unlocks outside lever and releases button. Closing door releases push button. Inside lever always free.
- B. Function Codes for Mortise Locks: Complying with BHMA A156.13.
1. Code F01; Passage/Closet Latchset: Latch bolt by knobs at all times.
 2. Code F02; Privacy Lock: Latch bolt by knobs, deadbolt by turn inside or emergency key outside.
 3. Code F04; Entry/Office Lock: Deadlocking latch bolt by knobs except when outside knob is locked by buttons in face (edge), then by key outside.

4. Code F05; Classroom Lock: Deadlocking latch bolt by knobs. Outside knob locked by key outside. Inside knob always free.
 5. Code F07; Storeroom/Exit Lock: Deadlocking latch bolt by inside knob or key outside. Outside knob rigid.
 6. Code F08; Front Door Lock: Latch bolt is operated by knob from either side except when outside knob is made inoperative by a stop or mechanical means other than key. Deadbolt is operated by turn inside. Key outside operates both locks.
 7. Codes F10, F12, and F20; Entry/Office Lock: Latch bolt by knobs except when outside knob is made inoperative by buttons in face. Deadbolt by key outside and turn inside. Rotating inside knob retracts both bolts. Deadlocking latch.
 8. Code F13; Dormitory Lock: Latch bolt by knobs except when outside knob is locked by projecting deadbolt. Key outside retracts deadbolt and unlocks outside knob. Rotating inside knob retracts both bolts.
- C. Function Codes for Exit Devices: Complying with BHMA A156.3.
1. Code 01; Exit Device: Exit only/no trim.
 2. Code 02; Exit Device: Entrance by pull/trim when actuating bar is locked down (Dogged-Down). Note-Fire Exit devices cannot be locked down.
 3. Code 03; Exit Device: Entrance by trim when latchbolt is retracted by key (pullside). Unit is locked when the key is removed.
 4. Code 04; Exit Device: Entrance by trim when latchbolt is retracted by key (pullside) or set in a retracted position by key.
 5. Code 05; Exit Device: Entrance by thumbpiece. Key (pullside) locks/unlocks thumbpiece.
 6. Code 06; Exit Device: Entrance by thumbpiece only when released by key (pullside). Unit is locked when the key is removed.
 7. Code 07; Exit Device: Entrance by thumbpiece. Inside key (on pushside/on active device case) locks/unlocks thumbpiece. Outside key (pullside) retracts latch.
 8. Code 08; Exit Device: Entrance by knob/lever. Key (pullside) locks/unlocks knob/lever.
 9. Code 09; Exit Device: Entrance by knob/lever with key (pullside) only. Unit is locked when the key is removed.
 10. Code 10; Exit Device: Entrance by knob/lever. Inside key (pushside) locks/unlocks knob/lever. Outside key (pullside) only retracts latch.
 11. Code 11; Exit Device: Entrance by auxiliary control turnpiece. Key (pullside) locks/unlocks auxiliary control.
 12. Code 12 ; Exit Device: Entrance by auxiliary control turnpiece only when released by turning key (pullside). Unit is locked when the key is removed.

2.4 FINISHES

- A. Finishes: Complying with BHMA A156.18.
1. Code 604: Zinc plated and dichromate sealed, with steel base material.
 2. Code 626: Satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D).
 3. Code 630: Satin stainless steel, with stainless steel 300 series base material (former US equivalent US32D).
 4. Code 652: Satin chromium plated over nickel, with steel base material (former US equivalent US26D).
 5. Code 689: Aluminum painted, with any base material (former US equivalent US28).

PART 3 EXECUTION

3.1 DOOR HARDWARE SCHEDULE

- A. Organize listing of door hardware components within each hardware set in compliance with 10-Part scheduling sequence indicated in DHI (H&S), unless otherwise indicated.

3.2 HARDWARE SET # 01: "EXTERIOR VESTIBULE"

- A. For use on Door Number(s): 100-1, 100-2, 100-5.
 B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
1 EA		CONTINUOUS HINGE	112XY	628	IVE
1 EA		CONTINUOUS HINGE	112XY EPT	628	IVE
1 EA		EXIT DEVICE	3549A - 360L - QEL	US26D	VD
1 EA		EXIT DEVICE	3549A - 360L	US26D	VD
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4040XP	689	LCN
1 EA		ACTUATOR	8310-818T		LCN
2 EA		FLOOR STOP	FS444	US26D	IVE
1 EA		THRESHOLD	2005AT X OPENING WIDTH		PE
2 EA		SWEEP	345ANB X DOOR WIDTH		PE
1 EA		DRIP CAP	346 X OPENING WIDTH		PE
2 EA		ASTRAGAL	305CN X DOOR HEIGHT		PE
1 EA		WIRING HARNESS	CON192 X LENGTH		VD
1 EA		WIRING HARNESS	CON32		VD
2 EA		POWER TRANSFER	EPT-10		VD
2 EA		POSITION SWITCH	679		SCH
1 EA		POWER SUPPLY	PS902		SCH

- C. Doors to have access control and ADA push button. Contractor to coordinate with owner's contractor to provide proper rough-in/prep.

3.3 HARDWARE SET # 02: "INTERIOR VESTIBULE"

- A. For use on Door Number(s): 100-3, 100-4.
 B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
1 EA		CONTINUOUS HINGE	112XY	628	IVE
1 EA		CONTINUOUS HINGE	112XY EPT	628	IVE
1 EA		EXIT DEVICE	3549A - 360L - QEL	US26D	VD
1 EA		EXIT DEVICE	3549A - 360L	US26D	VD
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4040XP	689	LCN
1 EA		ACTUATOR	8310-818T		LCN
2 EA		FLOOR STOP	FS444	US26D	IVE
2 EA		SWEEP	345ANB X DOOR WIDTH		PE
2 EA		ASTRAGAL	305CN X DOOR		PE

			HEIGHT		
1 EA		WIRING HARNESS	CON192 X LENGTH		VD
1 EA		WIRING HARNESS	CON32		VD
2 EA		POSITION SWITCH	679		SCH
1 EA		POWER SUPPLY	PS902		SCH

- C. Doors to have ADA push button. Contractor to coordinate with owner's contractor to provide proper rough-in/prep.

3.4 HARDWARE SET # 03: "EXTERIOR - ENTRY"

- A. For use on Door Number(s): 124-2, 124-4.
 B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
1 EA		CONTINUOUS HINGE	112XY	628	IVE
1 EA		CONTINUOUS HINGE	112XY EPT	628	IVE
1 EA		EXIT DEVICE	3549A - 360L - QEL	US26D	VD
1 EA		EXIT DEVICE	3549A - 360L	US26D	VD
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4040XP	689	LCN
2 EA		FLOOR STOP	FS444	US26D	IVE
1 EA		ACTUATOR	8310-856T	689	LCN
1 EA		THRESHOLD	2005AT X OPENING WIDTH		PE
1 EA		DRIP CAP	346 X OPENING WIDTH		PE
2 EA		SWEEP	345ANB X DOOR WIDTH		PE
2 EA		ASTRAGAL	305CN X DOOR HEIGHT		PE
1 EA		WIRING HARNESS	CON192 X LENGTH		VD
1 EA		WIRING HARNESS	CON32		VD
2 EA		POSITION SWITCH	679		SCH
1 EA		POWER SUPPLY	PS902		SCH

- C. Doors to have access control and ADA push button. Contractor to coordinate with owner's contractor to provide proper rough-in/prep.

3.5 HARDWARE SET # 04: "EXTERIOR - ENTRY"

- A. For use on Door Number(s): 124-6, 125-2.
 B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
1 EA		CONTINUOUS HINGE	112XY EPT	628	IVE
1 EA		EXIT DEVICE	3549A - 360L - QEL	US26D	VD
1 EA		PERMANENT CORE	OWNER SUPPLIED		
1 EA		DOOR CLOSER	4040XP	689	LCN
1 EA		FLOOR STOP	FS444	US26D	IVE

1 EA		THRESHOLD	2005AT X OPENING WIDTH		PE
1 EA		DRIP CAP	346 X OPENING WIDTH		PE
1 EA		SWEEP	345ANB X DOOR WIDTH		PE
1 EA		WIRING HARNESS	CON192 X LENGTH		VD
1 EA		WIRING HARNESS	CON32		VD
1 EA		POWER SUPPLY	PS902		SCH

- C. Doors to have access control. Contractor to coordinate with owner's contractor to provide proper rough-in/prep.

3.6 HARDWARE SET # 05: "EXTERIOR - EMERGENCY EGRESS"

- A. For use on Door Number(s): 200-4.

- B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
2 EA		CONTINUOUS HINGE	112XY	628	IVE
2 EA		EXIT DEVICE	3549A - 360L	US26D	VD
1 EA		EXIT LOCK	L9026HD	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4050A	689	LCN
2 EA		FLOOR STOP	FS444	US26D	IVE
1 EA		THRESHOLD	2005AT X OPENING WIDTH		PE
1 EA		DRIP CAP	346 X OPENING WIDTH		PE
2 EA		SWEEP	345ANB X DOOR WIDTH		PE

- C. Door to serve as a means of emergency egress only.

3.7 HARDWARE SET # 06: "MECHANICAL"

- A. For use on Door Number(s): 100-10, 104-1, 109-1, 115-1, 119-1, 126-2, 136-1, 136-2, 201-1 (BID ALT), 202-1 (BID ALT).

- B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
3 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		STOREROOM LOCK	L9080HD	626	SCH
1 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
1 EA		WALL STOP	WS407CVX	630	IVE
1 EA		KD HOLDER	FS455	US26D	IVE
3 EA		SILENCER	SR64	GRY	IVE

- C. _____.

3.8 HARDWARE SET # 07: "MECHANICAL"

- A. For use on Door Number(s): 110-1, 117-1, 126-1.

- B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
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6 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		STOREROOM LOCK	L9080HD	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
1 EA		DOOR CLOSER	4040XP	689	LCN
2 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
2 EA		WALL STOP	WS407CVX	630	IVE
2 EA		KD HOLDER	FS455	US26D	IVE
2 EA		FLUSH BOLT	FB358	US26D	IVE
2 EA		DUST-PROOF STRIKE	DP1	US26D	IVE
1 EA		ASTRAGAL	359		PEM
6 EA		SILENCER	SR64	GRY	IVE

C. _____.

3.9 HARDWARE SET # 08: "UNISEX RR"

- A. For use on Door Number(s): 105-1, 106-1, 120-1.
 B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
3 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		PRIVACY LOCK	L9040 17A	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
1 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
1 EA		WALL STOP	WS407CVX	630	IVE
3 EA		SILENCER	SR64	GRY	IVE

C. _____.

3.10 HARDWARE SET # 09: "EXISTING CORRIDOR"

- A. For use on Door Number(s): 100-6, 100-7, 100-8, 100-9.
 B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
2 EA		CONTINUOUS HINGE	112XY	628	IVE
2 EA		EXIT DEVICE	3549A - 360L	US26D	VD
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4040XP	689	LCN
1 EA		THRESHOLD	2005AT X DOOR WIDTH		PE
2 EA		SWEEP	345ANB X DOOR WIDTH		PE
2 EA		ASTRAGAL	305CN X DOOR HEIGHT		PE

C. _____.

3.11 HARDWARE SET # 10: "AUDITORIUM"

- A. For use on Door Number(s): 124-1, 200-1, 200-2, 200-3, 200-5, 200-6.
 B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
6 EA		HINGE	5BB1 4.5 X 4.5	652	IVE

1 EA		EXIT DEVICE	3549A - 360L	US26D	VD
1 EA		CLASSROOM LOCK	L9070HD	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4040XP	689	LCN
2 EA		WALL STOP	WS407CVX	630	IVE
2 EA		FLOOR STOP	FS444	US26D	IVE
2 EA		KD HOLDER	FS455	US26D	IVE
1 EA		ASTRAGAL	359		PEM
1 EA		SEAL KIT	PEMKOSTCSET-1A		PEM

C. _____.

3.12 HARDWARE SET # 11: "STAGE"

A. For use on Door Number(s): 122-1, 122-2.

B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
6 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		INNER ENTRY LOCK	L9056HD	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
2 EA		DOOR CLOSER	4050A 180	689	LCN
2 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
2 EA		WALL STOP	WS407CVX	630	IVE
2 EA		FLOOR STOP	FS444	US26D	IVE
2 EA		KD HOLDER	FS455	US26D	IVE
1 EA		ASTRAGAL	359		PEM
2 EA		SEAL KIT	PEMKOSTCSET-1A		PEM

C. Door to have ability to open 180 degrees..

3.13 HARDWARE SET # 12: "CLASSROOM"

A. For use on Door Number(s): 127-2, 128-1, 128-2.

B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
3 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		CLASSROOM LOCK	L9071HD 17A	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
1 EA		DOOR CLOSER	4040XP	689	LCN
1 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
1 EA		WALL STOP	WS407CVX	630	IVE
1 EA		FLOOR STOP	FS444	US26D	IVE
1 EA		KD HOLDER	FS455	US26D	IVE
1 EA		SEAL KIT	PEMKOSTCSET-1A		PEM

C. _____.

3.14 HARDWARE SET # 13: "CLASSROOM"

- A. For use on Door Number(s): 125-1, 127-1.
 B. Provide for each Pair (PR) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
6 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		CLASSROOM LOCK	L9071HD 17A	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
1 EA		DOOR CLOSER	4040XP	689	LCN
2 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
2 EA		WALL STOP	WS407CVX	630	IVE
2 EA		FLOOR STOP	FS444	US62D	IVE
2 EA		KD HOLDER	FS455	US26D	IVE
2 EA		FLUSH BOLT	FB358	US26D	IVE
2 EA		DUST PROOF STRIKE	DP1	US26D	IVE
1 EA		ASTRAGAL	359		PEM
2 EA		SEAL KIT	PEMKOSTCSET-1A		PEM

- C. _____.

3.15 HARDWARE SET # 14: "DRESSING"

- A. For use on Door Number(s): 129-1, 130-1.
 B. Provide for each Single (SGL) door(s).

UNITS	LOCK	ITEM	DESCRIPTION	FINISH	MFR
3 EA		HINGE	5BB1 4.5 X 4.5	652	IVE
1 EA		PASSAGE LOCK	L9010HD	626	SCH
1 EA		PERMANENT CORE	OWNER SUPPLIED		
1 EA		DOOR CLOSER	4040XP	689	LCN
1 EA		KICK PLATE	8400 10" X 2" LDW	630	IVE
1 EA		WALL STOP	WS407CVX	630	IVE
3 EA		SILENCER	SR64	GRY	IVE

- C. _____.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Fire-rated hollow metal doors and frames.
- D. Hollow metal borrowed lites glazing frames.

1.2 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing: Glass for doors and borrowed lites.
- C. Section 099113 - Exterior Painting: Field painting.
- D. Section 099123 - Interior Painting: Field painting.

1.3 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Coordinate requirements for installation of door hardware, electricified door hardware, and access control and security systems.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 ABBREVIATIONS AND ACRONYMS

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

1.6 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors 2022.
- C. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100) 2017.
- D. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames 2020.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- F. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable 2021a.
- G. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength 2018a.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- I. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.
- J. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- K. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames 2002.
- L. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames 2011.

- M. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames 2017.
- N. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- O. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- P. UL (DIR) - Online Certifications Directory Current Edition.
- Q. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.7 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.
- D. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on the Drawings. Coordinate with final door hardware schedule.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project site storage. Do not use nonvented plastic.
 - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- C. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.
- D. Deliver welded frames with two removeable spreader bars across the bottom of frames, tack welded to jambs and mullions.
- E. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Hollow Metal Doors and Frames: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com.
 - 2. Curries, an Assa Abloy Group company: www.assaabloydss.com.
 - 3. Fleming Door Products, an Assa Abloy Group company: www.assaabloydss.com.
 - 4. Mesker, dormakaba Group: www.meskeropeningsgroup.com/#sle.
 - 5. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
 - 6. Steelcraft, an Allegion brand: www.allegion.com/#sle.

2.2 PERFORMANCE REQUIREMENTS

- A. Requirements for Hollow Metal Doors and Frames:
- B. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

- E. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ATM E 136 for combustion characteristics.
- F. Accessibility: Comply with ICC A117.1 and ADA Standards.
- G. Fire-Rated Assemblies: Comply with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.
- H. Door Edge Profile: Manufacturers standard for application indicated.
- I. Typical Door Face Sheets: Flush.
- J. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Mitered hairline joints.
 - 1. Provide stops and moldings flush with face of door, and with beveled stops unless otherwise indicated.
- K. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- L. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.38 deg Btu/F x h x sq. ft. when tested according to ASTM C 518.
- M. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- N. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3 HOLLOW METAL DOORS

- A. Door Finish: Factory primed and field finished.
- B. Exterior Doors: Thermally insulated.
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 3 - Extra Heavy-duty.
 - b. Physical Performance Level A, 1,000,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 16 gage, 0.053 inch, minimum.
 - e. Zinc Coating: A 40 /ZF 120 galvanized coating; ASTM A653/A653M.
 - 2. Door Core Material: Polyisocyanurate, 2 lbs/cu ft minimum density.
 - a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
 - 3. Door Thermal Resistance: R-Value of 9.9, minimum, for installed thickness of polyisocyanurate.
 - 4. Door Thickness: 1-3/4 inch, nominal.
 - 5. Top Closures: Flush with top of faces and edges.
 - 6. Door Face Sheets: Flush.
 - 7. Weatherstripping: Refer to Section 087100.
 - 8. Door Type & Finish: As indicated in Door and Frame Schedule.
- C. Interior Doors, Non-Fire Rated:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

- a. Level 2 - Heavy-duty.
- b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
- c. Model 1 - Full Flush.
- d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
- 2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
- 3. Door Thickness: 1-3/4 inch, nominal.
- 4. Door Face Sheets: Flush.
- 5. Door Type & Finish: As indicated in Door and Frame Schedule.
- D. Fire-Rated Doors:
 - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
 - a. Level 2 - Heavy-duty.
 - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
 - c. Model 1 - Full Flush.
 - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
 - 2. Fire Rating: As indicated on drawings, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
 - 3. Provide units listed and labeled by UL (DIR).
 - a. Attach fire rating label to each fire rated unit.
 - 4. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
 - 5. Door Thickness: 1-3/4 inch, nominal.
 - 6. Door Face Sheets: Flush.
 - 7. Door Type & Finish: As indicated in Door and Frame Schedule.

2.4 HOLLOW METAL FRAMES

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished indicated in Drawings.
- C. Exterior Door Frames: Full profile/continuously welded type.
 - 1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
 - 3. Weatherstripping: Separate, see Section 087100.
- D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
 - 1. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- E. Door Frames, Fire-Rated: Full profile/continuously welded type.
 - 1. Fire Rating: Same as door, labeled.
 - 2. Frame Metal Thickness: 16 gage, 0.053 inch, minimum.
- F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- G. Mullions for Pairs of Doors: Removable type, with profile similar to jambs.
- H. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- I. Transom Bars: Fixed, of profile same as jamb and head.
- J. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.
- K. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inch high to fill opening without cutting masonry units.

2.5 FRAME ANCHORS

- A. Frame Anchors: ASTM A879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
 - 1. For anchors built into exterior walls, steel sheet comply with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- B. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24-inches of frame height above 7-feet.
 - 3. Post-installed Expansion Anchor: Minimum 3/8-inch diameter bolts with expansion shield or inserts, with manufacturer's standard pipe spacer.
- C. Floor Anchors: Provide floor anchors for each jamb and mullion that extend to floor.

2.6 FINISHES

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.7 ACCESSORIES

- A. Glazing: As specified in Section 088000, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Section 08 7100.
- D. Grout for Frames: Portland cement grout with maximum 4 inch slump for hand troweling; thinner pumpable grout is prohibited.
- E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restor exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.
- B. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.
- C. Drill and tap doors and frames to receive mortised and surface-mounted door hardware.

3.3 INSTALLATION

- A. Install doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- E. Install door hardware as specified in Section 087100.
- F. Comply with glazing installation requirements of Section 088000.
- G. Coordinate installation of electrical connections to electrical hardware items.
- H. Touch up damaged factory finishes.

3.4 TOLERANCES

- A. Hollow-Metal Frames:
 - 1. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.
 - 2. Squareness: Plus or minus 1/16-inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - 3. Alignment: Plus or minus 1/16-inch, measured at jambs on a horizontal line parallel to plane of wall.
 - 4. Plumbness: Plus or minus 1/16-inch, measured at jambs at floor.
- B. Hollow-Metal Doors:
 - 1. Non-Fire-Rated Steel Doors: Comply with SDI A250.8 or NAAMM-HMMA 841 and NAAMM-HMMA guide specification indicated.
 - 2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

3.5 ADJUSTING

- A. Adjust for smooth and balanced door movement.

3.6 CLEANING AND TOUCH-UP

- A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

END OF SECTION

SECTION 081416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.2 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 087100 - Door Hardware.
- C. Section 088000 - Glazing.

1.3 REFERENCE STANDARDS

- A. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- B. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.
- C. WDMA I.S. 1A - Interior Architectural Wood Flush Doors 2021, with Errata (2022).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
- D. Samples: For factory-finished veneers.
- E. Warranty, executed in Owner's name.

1.5 CLOSEOUT SUBMITTALS

- A. Owner's Manual and Maintenance Data.
- B. Manufacturer's Warranty Form.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.
- D. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.7 WARRANTY

- A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
 - 1. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide product indicated in Drawings; or a comparable product by one of the following:
 - 1. Eggers Industries; <>
 - 2. Graham Wood Doors
 - 3. Marshfield DoorSystems, Inc; _____
 - 4. VT Industries.
 - 5. OshKosh Door Company.

2.2 DOORS

- A. Doors: See drawings for locations and additional requirements.

1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.
2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 1. Provide solid core doors at each location.
 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) labeled without any visible seals when door is closed.
 3. Wood veneer facing with factory transparent finish as indicated on drawings.

2.3 DOOR CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.4 DOOR FACINGS

- A. Veneer Facing for Transparent Finish: As indicated in Drawings, HPVA Grade A, plain sliced (flat cut), with book match between leaves of veneer, balance match of spliced veneer leaves assembled on door or panel face; unless otherwise indicated.
 1. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.
 2. Transoms: Continuous match to doors.

2.5 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- E. Provide edge clearances in accordance with the quality standard specified.

2.6 FINISHES - WOOD VENEER DOORS

- A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:
 1. Transparent:
 - a. System - TR-6, Catalyzed Polyurethane.
 - b. Stain: As indicated on Drawings.
 - c. Sheen: Satin.
 - d. Grade: Premium.
 - e. Effect: Open-grain finish.
- B. Factory finish doors in accordance with approved sample.

2.7 ACCESSORIES

- A. Hollow Metal Door Frames: See Section 081113.
- B. Glazing: See Section 088000.
- C. Glazing Stops: Wood, of same species as door facing, mitered corners; prepared for countersink style tamper proof screws.
- D. Door Hardware: See Section 087100.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.
- D. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
 - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

3.3 TOLERANCES

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.
- C. Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION

SECTION 083100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Wall-mounted access units.

1.2 RELATED REQUIREMENTS

- A. Section 099123 - Interior Painting: Field paint finish.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

PART 2 PRODUCTS

2.1 ACCESS DOORS AND PANELS ASSEMBLIES

- A. Wall-Mounted Units:
 - 1. Location: As indicated on drawings.
 - 2. Panel Material: Steel.
 - 3. Size: 12 by 12 inches.
 - 4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
 - 5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

2.2 WALL-MOUNTED UNITS

- A. Manufacturers:
 - 1. Activar Construction Products Group - JL Industries: www.activarcpg.com/#sle.
 - 2. ACUDOR Products Inc: www.acudor.com/#sle.
 - 3. Babcock-Davis: www.babcockdavis.com/#sle.
 - 4. Best Access Doors: www.bestaccessdoors.com/#sle.
 - 5. Cendrex, Inc: www.cendrex.com/#sle.
 - 6. Elmdor: www.elmdor.com/#sle.
 - 7. FF Systems, Inc: www.ffsystemsinc.com/#sle.
 - 8. Karp Associates, Inc: www.karpinc.com/#sle.
 - 9. MIFAB, Inc: www.mifab.com/#sle.
 - 10. Milcor, Inc: www.milcorinc.com/#sle.
 - 11. Nystrom, Inc: www.nystrom.com/#sle.
 - 12. Studco Building Systems; _____: www.studcosystems.com/#sle.
 - 13. Substitutions: See Section 016000 - Product Requirements.
- B. Wall-Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
 - 1. Style: Exposed frame with door surface flush with frame surface.
 - 2. Door Style: Single thickness with rolled or turned in edges.
 - 3. Frames: 16 gauge, 0.0598 inch, minimum thickness.
 - 4. Steel Finish: Primed.
 - 5. Primed and Factory Finish: Polyester powder coat; color as selected by Architect from manufacturer's standard colors.
 - 6. Hardware:
 - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.

- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 083323 - OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Overhead coiling doors and shutters, operating hardware, fire-rated, non-fire-rated, and exterior, manual and electric operation.
- B. Wiring from electric circuit disconnect to operator to control station.

1.2 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications for miscellaneous steel supports.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide general construction, electrical equipment, and component connections and details.
- C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.
- E. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.

1.4 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

1.5 QUALITY ASSURANCE

- A. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" and ICC A117.1.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. General: Source Limitations - Obtain overhead coiling doors from single source from single manufacturer.
 - 1. Obtain operators and controls from overhead coiling-door manufacturer.
- B. Overhead Coiling Doors: Subject to compliance with requirements, provide product indicated in Drawings, or comparable product by one of the following:
 - 1. Alpine Overhead Doors, Inc: www.alpinedoors.com.
 - 2. Clopay Building Products: www.clopaydoor.com/#sle.
 - 3. The Cookson Company: www.cooksondoor.com.
 - 4. Overhead Door Corporation.
 - 5. ACME Rolling Doors
 - 6. McKeon Rolling Steel Door Company
 - 7. Raynor
 - 8. Substitutions: See Section 016000 - Product Requirements.

2.2 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
 - 2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1.
 - 3. Nominal Slat Size: 2 inches wide x required length.
 - 4. Finish: Factory painted, color as selected.

5. Guide, Angles: Galvanized steel.
6. Guides, Formed Sheet Metal: Galvanized steel.
7. Hood Enclosure: Manufacturer's standard; primed steel.
8. Electric operation.
9. Mounting: Within framed opening.
10. Locking Devices: Lock and latch handle on outside.

B. Non-Fire-Rated Interior Coiling Doors:

1. Nominal Slat Size: 2 inches wide x required length.
2. Finish: Factory painted, as indicated in Drawings.
3. Hood Enclosure: Manufacturer's standard; primed steel.
4. Mounting: Within framed opening.
5. Locking Devices: Slide bolt on inside.

2.3 MATERIALS AND COMPONENTS

A. Curtain Construction: Interlocking slats.

1. Slat Ends: Each slat fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.

B. Steel Slats: Minimum thickness, 24 gage, 0.028 inch; ASTM A653/A653M galvanized steel sheet.

1. Galvanizing: Minimum G90 coating.

C. Guide Construction: Continuous, of profile to retain door in place, mounting brackets of same metal.

D. Guides - Angle: ASTM A36/A36M metal angles, size as indicated.

1. Hot-dip galvanized in compliance with ASTM A123/A123M.

E. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.

1. Minimum thickness; 24 gage, 0.028 inch.
2. Prepare for site painted finish.

F. Lock Hardware:

1. For motor operated units, additional lock or latching mechanisms are not required.
2. Latch Handle: Manufacturer's standard.
3. Slide Bolt: Provide on single-jamb side, extending into slot in guides, with padlock on one side.

G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

2.4 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by testing agency acceptable to authorities having jurisdiction.

1. Provide interlock switches on motor operated units.
2. Provide tamperproof operation cycle counter.

B. Electric Operators:

1. Mounting: Center mounted.
2. Motor Enclosure:
 - a. Interior Coiling Doors: NEMA MG 1, Type 1; open drip proof.
3. Motor Voltage: 120 volts, single phase, 60 Hz.
4. Refer to Section 260583 for electrical connections.
5. Emergency Manual Operation: Chain type.
6. Obstruction Detection Device: Automatic photoelectric sensor.
7. Other Equipment: Audible and visual signals Portable radio-control system.

- C. Control Station: Provide standard three button (Open-Close-Stop) momentary-contact control device for each operator complying with UL 325.
 - 1. Surface mounted.
 - 2. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
 - a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.
- D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.
- E. Coordinate installation of electrical service with Section 260583.
- F. Complete wiring from disconnect to unit components.
- G. Install enclosure and perimeter trim.

3.3 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.4 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

SECTION 084313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.
- B. Section 087100 - Door Hardware: Hardware items other than specified in this section.
- C. Section 088000 - Glazing: Glass and glazing accessories.

1.3 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site 2015.
- B. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document) 2015.
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum 2020.
- D. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections 2009.
- E. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.
- F. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.
- G. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes 2021.
- I. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric) 2021.
- J. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- K. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with installation of other components that comprise the exterior enclosure.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.
- C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.
- D. Samples: Submit two samples 12 by 12 inches in size illustrating finished aluminum surface, glass, glazing materials.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide 10 year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
 - 1. Failure include, but are not limited to, the following:
 - 2. Structural failures, including but not limited to, excessive deflection.
 - 3. Noise or vibration created by wind and thermal and structural movements
 - 4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - 5. Water penetration through fixed glazing and framing areas.
 - 6. Failure of operating components.
- C. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.
 - 1. Special Finish Warranty: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
 - a. Deterioration includes, but is not limited to, the following:
 - 1) Color fading more than 5 Hunter units when tested according to ASTM D 2244.
 - 2) Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.
 - 3) Cracking, checking, peeling, or failure of paint to adhere to bare metal.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING - EXTERIOR

- A. Center-Set Style, Thermally-Broken:
 - 1. Basis of Design: Subject to compliance with requirements, provide EFCO Corporation; Series 403, Thermal Storefront Framing or a comparable product by one of the following:
 - a. Kawneer North America; an Alcoa company.
 - b. Manko Window Systems, Inc.
 - c. Vistawall Architectural Products.

2.2 BASIS OF DESIGN -- FRAMING FOR MONOLITHIC GLAZING - INTERIOR

- A. Center-Set Style:
 - 1. Basis of Design: Subject to compliance with requirements, provide EFCO Corporation; Series 401, Non-Thermal Storefront Framing or a comparable product by one of the following:
 - a. Kawneer North America; an Alcoa company.
 - b. Manko Window Systems, Inc.
 - c. Vistawall Architectural Products.

2.3 BASIS OF DESIGN -- SWINGING DOORS

- A. Wide Stile, Insulating Glazing, Thermally-Broken:
 - 1. Basis of Design: Subject to compliance with requirements, provide EFCO Corporation; Series D502 Thermastile or a comparable product by one of the following:
 - a. Kawneer North America; an Alcoa company.
 - b. Manko Window Systems, Inc.
 - c. Vistawall Architectural Products.

2.4 ALUMINUM-FRAMED STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
1. Finish: Class I color anodized.
 - a. Factory finish all surfaces that will be exposed in completed assemblies.
 2. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
 3. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
 4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
 5. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
 6. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
 7. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
 8. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.
- B. Performance Requirements:
1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
 - a. Design Wind Loads: Comply with requirements of ASCE 7.
 - b. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
 2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 12 psf.
 3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
 4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.

2.5 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, drainage holes and internal weep drainage system.
1. Glazing Stops: Flush.
 2. Cross-Section: As indicated on drawings.
- B. Glazing: As specified in Section 088000.
- C. Swing Doors: Glazed aluminum.
1. Bottom Rail: 10 inches wide.
 2. Glazing Stops: Square.
 3. Finish: Same as storefront.

2.6 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M).

- B. Fasteners: Stainless steel.
- C. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.
- D. Concealed Flashings: Stainless steel, 26 gage, 0.0187 inch minimum thickness.
- E. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch minimum thickness.
- F. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.
- G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- H. Glazing Accessories: As specified in Section 088000.

2.7 FINISHES

- A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

2.8 HARDWARE

- A. For each door, include weatherstripping.
- B. Other Door Hardware: As specified in Section 087100.
- C. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- I. Set thresholds in bed of sealant and secure.
- J. Install glass and infill panels in accordance with Section 088000, using glazing method required to achieve performance criteria.
- K. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4 ADJUSTING

- A. Adjust operating hardware for smooth operation.

3.5 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

- C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

3.6 PROTECTION

- A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 087100 - DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Hardware for wood, aluminum, and hollow metal doors.
- B. Hardware for fire-rated doors.
- C. Electrically operated and controlled hardware.
- D. Thresholds.
- E. Weatherstripping and gasketing.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealants for setting exterior door thresholds.
- B. Section 080671 - Door Hardware Schedule: Schedule of door hardware sets.
- C. Section 081113 - Hollow Metal Doors and Frames.
- D. Section 081116 - Aluminum Doors and Frames.
- E. Section 081416 - Flush Wood Doors.
- F. Section 084313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.
- G. Section 084413 - Glazed Aluminum Curtain Walls: Door hardware, including cylinders.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. BHMA (CPD) - Certified Products Directory Current Edition.
- C. BHMA A156.1 - Standard for Butts and Hinges 2021.
- D. BHMA A156.2 - Bored and Preamsembled Locks and Latches 2022.
- E. BHMA A156.3 - Exit Devices 2020.
- F. BHMA A156.4 - Door Controls - Closers 2019.
- G. BHMA A156.5 - Cylinders and Input Devices for Locks 2020.
- H. BHMA A156.6 - Standard for Architectural Door Trim 2021.
- I. BHMA A156.7 - Template Hinge Dimensions 2016.
- J. BHMA A156.13 - Mortise Locks & Latches Series 1000 2022.
- K. BHMA A156.16 - Auxiliary Hardware 2018.
- L. BHMA A156.18 - Materials and Finishes 2020.
- M. BHMA A156.20 - Standard for Strap and Tee Hinges, and Hasps 2021.
- N. BHMA A156.21 - Thresholds 2019.
- O. BHMA A156.22 - Standard for Gasketing 2021.
- P. BHMA A156.25 - Electrified Locking Devices 2023.
- Q. BHMA A156.26 - Standard for Continuous Hinges 2021.
- R. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators 2019.
- S. BHMA A156.36 - Auxiliary Locks 2020.
- T. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames 2016.
- U. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames 2006.
- V. DHI (H&S) - Sequence and Format for the Hardware Schedule 2019.
- W. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames 2004.
- X. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors 1993; also in WDHS-1/WDHS-5 Series, 1996.
- Y. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.
- Z. ITS (DIR) - Directory of Listed Products Current Edition.
- AA. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- BB. NFPA 80 - Standard for Fire Doors and Other Opening Protectives 2022.
- CC. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- DD. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives 2022.
- EE. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies 2022.
- FF. UL (DIR) - Online Certifications Directory Current Edition.
- GG. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.
- C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:
 - 1. Hardware Installer.
- D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- E. Keying Requirements Meeting:
 - 1. Schedule meeting at project site prior to Contractor occupancy.
 - 2. Attendance Required:
 - a. Contractor.
 - b. Owner.
 - c. Architect.
 - d. Hardware Installer.
 - e. Owner's Security Consultant.
 - 3. Agenda:
 - a. Establish keying requirements.
 - b. Verify locksets and locking hardware are functionally correct for project requirements.
 - c. Verify that keying and programming complies with project requirements.
 - d. Establish keying submittal schedule and update requirements.
 - 4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
 - a. Access control requirements.
 - b. Key control system requirements.
 - c. Schematic diagram of preliminary key system.
 - d. Flow of traffic and extent of security required.
 - 5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
 - 6. Deliver established keying requirements to manufacturers.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.
- C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
 - 1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
 - 2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
 - a. Submit in vertical format, refer to Section 08 0671.

3. List groups and suffixes in proper sequence.
 4. Provide complete description for each door listed.
 5. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
 6. Include account of abbreviations and symbols used in schedule.
- D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
 2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
 3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
- E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- F. Keying Schedule:
1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.
- G. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- I. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
 2. Lock Cylinders: Ten for each master keyed group.
 3. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience and approved by manufacturer.
- C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
 1. Closers: Five years, minimum.
 2. Exit Devices: Three years, minimum.
 3. Locksets and Cylinders: Three years, minimum.
 4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

- A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.
- B. Provide individual items of single type, of same model, and by same manufacturer.
- C. Provide door hardware products that comply with the following requirements:
 - 1. Applicable provisions of federal, state, and local codes.
 - 2. Accessibility: ADA Standards and ICC A117.1.
 - 3. Applicable provisions of NFPA 101.
 - 4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
 - 5. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.
 - 6. Listed and certified compliant with specified standards by BHMA (CPD).
 - 7. Auxiliary Hardware: BHMA A156.16.
 - 8. Straps and Tee Hinges: BHMA A156.20.
 - 9. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
 - 10. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
 - 11. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.
- D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.
- E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Section 08 0671 for listing of hardware sets.
- F. Fasteners:
 - 1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
 - a. Aluminum fasteners are not permitted.
 - b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
 - 2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
 - a. Self-drilling (Tek) type screws are not permitted.
 - 3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
 - 4. Provide wall grip inserts for hollow wall construction.
 - 5. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
 - 6. Fire-Rated Applications: Comply with NFPA 80.
 - a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
 - b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.
 - 7. Concealed Fasteners: Do not use through or sex bolt type fasteners on door panel sides indicated as concealed fastener locations, unless otherwise indicated.

2.2 HINGES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. McKinney; an Assa Abloy Group company; <>: www.assaabloydss.com.

2. Bommer Industries, Inc; <>: www.bommer.com.
 3. C. R. Laurence Co., Inc; <>: www.crl-arch.com.
 4. Hager Companies; <>: www.hagerco.com/#sle.
 5. Stanley, dormakaba Group; <>: www.stanleyhardwarefordoors.com/#sle.
 6. Ives; an Allegion brand; www.allegion.com/us.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
 - a. Provide hinge width required to clear surrounding trim.
 2. Continuous Hinges: Comply with BHMA A156.26.
 3. Provide hinges on every swinging door.
 4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
 5. Provide ball-bearing hinges at each door with closer.
 6. Provide non-removable pins on exterior outswinging doors.
 7. Provide non-removable pins on interior outswinging doors at locations as indicated.
 8. Provide power transfer hinges where electrified hardware is mounted in door leaf.
 9. Provide following quantity of butt hinges for each door:
 - a. Doors up to 60 inches High: Two hinges.
 - b. Doors From 60 inches High up to 90 inches High: Three hinges.
 - c. Doors 90 inches High up to 120 inches High: Four hinges.
 - d. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.
 - e. Dutch Doors: Two hinges each leaf.

2.3 FLUSH BOLTS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Adams Rite, an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. Hager Companies; <>: www.hagerco.com/#sle.
 3. Ives, an Allegion brand; <>: www.allegion.com/us.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Flush Bolts: Comply with BHMA A156.16, Grade 1.
1. Flush Bolt Throw: 3/4 inch, minimum.
 2. Provides extension bolts in leading edge of door, one bolt into floor, one bolt into top of frame.
 - a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
 3. Provide dustproof floor strike for bolt into floor, except at metal thresholds.

2.4 EXIT DEVICES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. C. R. Laurence Company, Inc; <>: www.crl-arch.com.
 3. DORMA USA, Inc; 8000 Series: www.dorma.com/#sle.
 4. Hager Companies; <>: www.hagerco.com/#sle.
 5. Stanley, dormakaba Group; <>: www.stanleyhardwarefordoors.com/#sle.
 6. Von Duprin, an Allegion brand; <>: www.allegion.com/us.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.

2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.
6. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
7. For electrical options, provide quick connect plug-in pre-wired connectors.

2.5 ELECTRIC STRIKES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Adams Rite, HES, or Securitron; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. Von Duprin; an Allegion brand; www.allegion.com/us..
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
 1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
 2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.
 3. Provide transformer and rectifier as necessary for complete installation.
 4. Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

2.6 LOCK CYLINDERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Best, dormakaba Group; <>: www.bestaccess.com/#sle.
 2. Schlage; an Allegion brand; www.allegion.com/us..
 3. Yale; an Assa Abloy Group company; www.assaabloydss.com.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
 1. Provide standard, electronic, conventional, full size interchangeable core (FSIC), and small format interchangeable core (SFIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
 2. Provide cylinders from same manufacturer as locking device.
 3. Provide cams and/or tailpieces as required for locking devices.

2.7 CYLINDRICAL LOCKS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. Schlage, an Allegion brand; <>: www.allegion.com/us.
 3. Stanley, dormakaba Group; <>: www.stanleyhardwarefordoors.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
 1. Bored Hole: 2-1/8 inch diameter.
 2. Latchbolt Throw: 1/2 inch, minimum.
 3. Backset: 2-3/4 inch unless otherwise indicated.
 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Finish: To match lock or latch.

- b. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
 - c. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
 - d. Rabbet Front and Strike: Provide on locksets for use with rabbeted meeting rails.
5. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.8 MORTISE LOCKS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Corbin Russwin, Sargent, or Yale; an Assa Abloy Group company; <>: www.assaabloydss.com.
 - 2. Schlage, an Allegion brand; <>: www.allegion.com/us.
 - 3. Stanley, dormakaba Group; <>: www.stanleyhardwarefordoors.com/#sle.
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Mortise Locks: Comply with BHMA A156.13, Grade 1, Security, 1000 Series.
 - 1. Latchbolt Throw: 3/4 inch, minimum.
 - 2. Deadbolt Throw: 1 inch, minimum.
 - 3. Backset: 2-3/4 inch unless otherwise indicated.
 - 4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
 - a. Flat-Lip Strikes: Provide for locks with three piece antifriction latchbolts as recommended by manufacturer.
 - b. Aluminum-Frame Strike Box: Provide strike box fabricated for use with aluminum framing by framing manufacturer.
 - c. Rabbet Front and Strike: Provide on locksets for use with rabbeted meeting rails.
 - d. Finish: To match lock or latch.

2.9 ELECTROMECHANICAL LOCKS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Sargent or Yale; an Assa Abloy Group company; <>: www.assaabloydss.com.
 - 2. Schlage, an Allegion brand; <>: www.allegion.com/us.
 - 3. Substitutions: See Section 016000 - Product Requirements.
- B. Electromechanical Locks: Comply with BHMA A156.25, Grade 1.
 - 1. Provide motor-driven or solenoid-driven locks, with strike that is applicable to frame.
 - 2. Type: Mortise deadbolt.

2.10 AUXILIARY LOCKS (DEADLOCKS)

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Yale; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 - 2. Stanley, dormakaba Group; <>: www.stanleyhardwarefordoors.com/#sle.
 - 3. [Schlage, an Allegion brand; <> : www.allegion.com/us.]
 - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Auxiliary Locks (Deadlocks): Comply with BHMA A156.36, Grade 1.
 - 1. Type: Bored (cylindrical).
 - 2. Application: Bored.
 - 3. Backset: 2-3/4 inch, unless otherwise indicated.
 - 4. Bolt Throw: 1/2 inch, with latch made of hardened steel.
 - 5. Provide strike that matches frame.

2.11 DOOR PULLS AND PUSH PLATES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: www.activarcpg.com/hiawatha/#sle.
 3. Trimco; <>: www.trimcohardware.com/#sle.
 4. [Ives, an Allegion brand; <> : www.allegion.com/us.].
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Door Pulls and Push Plates: Comply with BHMA A156.6.
 1. Pull Type: Straight, unless otherwise indicated.
 2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
 - a. Edges: Beveled, unless otherwise indicated.
 3. Material: Aluminum, unless otherwise indicated.
 4. On solid doors, provide matching door pull and push plate on opposite faces.
 5. On glazed storefront doors, provide matching door pulls/push plates on both faces unless otherwise indicated.

2.12 DOOR PULLS AND PUSH BARS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: www.activarcpg.com/hiawatha.
 3. Trimco; <>: www.trimcohardware.com.
 4. [Ives, an Allegion brand; <> : www.allegion.com/us.].
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Door Pulls and Push Bars: Comply with BHMA A156.6.
 1. Bar Type: Bar set, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.

2.13 COORDINATORS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: www.activarcpg.com/hiawatha/#sle.
 3. Ives, an Allegion brand; <>: www.allegion.com/us/#sle.
 4. Trimco; <>: www.trimcohardware.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.
 1. Type: Bar, unless otherwise indicated.
 2. Material: Aluminum, unless otherwise indicated.
 3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.14 CLOSERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following: Surface Mounted:
 1. Corbin Russwin, Norton, Rixson, Sargent, or Yale; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. C. R. Laurence Company, Inc; <>: www.crl-arch.com.
 3. LCN, an Allegion brand; <>: www.allegion.com/us.

4. Stanley, dormakaba Group; <>: www.stanleyhardwarefordoors.com/#sle.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: Surface mounted to door.
 2. Provide door closer on each exterior door.
 3. Provide door closer on each fire-rated and smoke-rated door.
 - a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.
 4. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.
 5. At corridor entry doors, mount closer on room side of door.
 6. At outswinging exterior doors, mount closer on interior side of door.

2.15 PROTECTION PLATES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. C. R. Laurence Company, Inc; <>: www.crl-arch.com.
 3. Hiawatha, Inc, an Activar Construction Products Group company; <>: www.activarcpg.com/hiawatha.
 4. Ives, an Allegion brand; <>: www.allegion.com/us.
 5. Trimco; <>: www.trimcohardware.com.
 6. Substitutions: See Section 016000 - Product Requirements.
- B. Protection Plates: Comply with BHMA A156.6.
- C. Metal Properties: Aluminum.
1. Metal, Standard Duty: Thickness 0.05 inch, minimum.
- D. Edges: Square, on four sides unless otherwise indicated.
- E. Fasteners: Countersunk screw fasteners.
- F. Drip Guard: Provide at head of exterior doors unless covered by roof or canopy.

2.16 KICK PLATES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Hiawatha, Inc, an Activar Construction Products Group company; <>:
 2. Ives, an Allegion brand; <>: www.allegion.com/us/#sle.
 3. Trimco; <>: www.trimcohardware.com/#sle.
 4. [Rockwood; an Assa Abloy Group company; <> : www.assaabloydss.com.]
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Kick Plates: Provide along bottom edge of push side of every door with closer, except aluminum storefront and glass entry doors, unless otherwise indicated.
1. Size: 8 inch high by 2 inch less door width (LDW) on push side of door.

2.17 DOOR HOLDERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. McKinney or Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. C. R. Laurence Company, Inc; <>: www.crl-arch.com.
 3. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: www.activarcpg.com/hiawatha.
 4. Trimco; <>: www.trimcohardware.com.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Door Holders: Comply with BHMA A156.16, Grade 1.
1. Type: Lever, or kick down stop, with rubber bumper at bottom end.

2. Material: Aluminum.

2.18 FLOOR STOPS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: www.activarcpg.com/hiawatha.
 3. Trimco; <>: www.trimcohardware.com.
 4. Ives; an Allegion brand;.
 5. Substitutions: See Section 016000 - Product Requirements.
- B. Floor Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide floor stops when wall surface is not available; be cautious not to create a tripping hazard.
 2. Type: Manual hold-open, with pencil floor stop.
 3. Material: Aluminum housing with rubber insert.

2.19 WALL STOPS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 2. Hiawatha, Inc, division of Activar Construction Products Group, Inc; <>: www.activarcpg.com/hiawatha/#sle.
 3. Trimco; <>: www.trimcohardware.com/#sle.
 4. Substitutions: See Section 016000 - Product Requirements.
- B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Provide wall stops to prevent damage to wall surface upon opening door.
 2. Type: Bumper, concave, wall stop.
 3. Material: Aluminum housing with rubber insert.

2.20 ASTRAGALS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Pemko; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 2. Zero International, Inc; <>: www.zerointernational.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Astragals: Comply with BHMA A156.22.
1. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
 2. Type: Split, two parts, and with sealing gasket.
 3. Material: Aluminum, with neoprene weatherstripping.
 4. Provide non-corroding fasteners at exterior locations.

2.21 THRESHOLDS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Pemko; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 2. Zero International, Inc; <>: www.zerointernational.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
 2. Type: Flat surface.
 3. Material: Aluminum.

4. Threshold Surface: Fluted horizontal grooves across full width.
5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.

2.22 WEATHERSTRIPPING AND GASKETING

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Pemko; an Assa Abloy Group company; <>: www.assaabloydss.com.
 2. Zero International, Inc: www.zerointernational.com.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
 1. Door Sweep Type: Encased in retainer.
 2. Provide gasketing for smoke and draft control doors that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
 3. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated; .
 4. Provide door bottom sweep on each exterior door, unless otherwise indicated.
 5. Provide sound-rated gasketing and automatic door bottom on doors indicated as "Sound-Rated", "Acoustical", or with "Sound Transmission Class (STC) rating"; fabricate as continuous gasketing, do not cut or notch gasketing material.

2.23 SILENCERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 1. Ives, an Allegion brand; <><>: www.allegion.com/us/#sle.
 2. Rockwood; an Assa Abloy Group company; <>: www.assaabloydss.com/#sle.
 3. Substitutions: See Section 016000 - Product Requirements.
- B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
 1. Single Door: Provide three on strike jamb of frame.
 2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
 3. Material: Rubber, gray color.

2.24 FIRE DEPARTMENT LOCK BOX

- A. Fire Department Lock Box:
 1. Heavy-duty, surface mounted, solid stainless-steel box with hinged door and interior gasket seal; single drill resistant lock with dust covers and tamper alarm.
 2. Capacity: Holds 2 keys.
 3. Finish: Manufacturer's standard dark bronze.

2.25 EXIT MOTION SENSOR

- A. Manufacturers:
 1. Securitron; an Assa Abloy Group company; _____: www.assaabloydss.com/#sle.
 2. Substitutions: See Section 016000 - Product Requirements.
- B. Exit Motion Sensor: Interior passive infrared detection device to initiate door release of exit door magnetic lock.
 1. Power: 12 VDC.
 2. Provide adjustable detector face to allow for precise pattern configurations, and easy pattern adjustment.
 3. Provide relay that operates before transistor to prevent false alarms.
 4. Operating Temperature: 32 to 110 degrees F.

2.26 POWER SUPPLY

- A. Manufacturers:
 1. Securitron; an Assa Abloy Group company; <>: www.assaabloydss.com.

2. Substitutions: See Section 016000 - Product Requirements.
- B. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.
 1. Power: 24 VAC, 10 Amp; with 120 VAC power supply.
 2. Operating Temperature: 32 to 110 degrees F.
 3. Provide with emergency release terminals that release devices upon activation of fire alarm system.

2.27 FINISHES

- A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
 1. Primary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
 2. Exceptions:
 - a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
 - b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.
 - c. Door Closer Covers and Arms: Color as selected by Architect from manufacturer's standard colors unless otherwise indicated.
 - d. Aluminum Surface Trim and Gasket Housings: Anodized to match door panel finish, not other hardware, unless otherwise indicated.
 - e. Hardware for Aluminum Storefront Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of correct characteristics.

3.2 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.
- C. Install hardware for smoke and draft control doors in accordance with NFPA 105.
- D. Use templates provided by hardware item manufacturer.
- E. Do not install surface mounted items until application of finishes to substrate are fully completed.
- F. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
 1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
 2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
 3. Mounting heights in compliance with ADA Standards:
 - a. Locksets: 40-5/16 inch.
 - b. Push Plates/Pull Bars: 42 inch.
 - c. Deadlocks (Deadbolts): 48 inch.
 - d. Exit Devices: 40-5/16 inch.
 - e. Door Viewer: 43 inch; standard height 60 inch.
- G. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3 ADJUSTING

- A. Adjust hardware for smooth operation.
- B. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.4 CLEANING

- A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.
- B. Clean adjacent surfaces soiled by hardware installation.
- C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.5 PROTECTION

- A. Protect finished Work under provisions of Section 017000 - Execution and Closeout Requirements.
- B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 088000 - GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Insulating glass units.
- B. Glazing units.
- C. Glazing compounds.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.
- B. Section 081113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.
- C. Section 081416 - Flush Wood Doors: Glazed lites in doors.
- D. Section 088723 - Safety and Security Films.

1.3 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers 2005 (Reapproved 2019).
- D. ASTM C1036 - Standard Specification for Flat Glass 2021.
- E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass 2018.
- F. ASTM C1193 - Standard Guide for Use of Joint Sealants 2016.
- G. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass 2021a.
- H. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings 2016.
- I. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation 2019.
- J. GANA (SM) - GANA Sealant Manual 2008.
- K. NFRC 100 - Procedure for Determining Fenestration Product U-factors 2020.
- L. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence 2020.
- M. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting a minimum 5 business days before starting work of this section; require attendance by each of the affected installers.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.
- C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.
- D. Samples: Submit 1 sample 12 inch by 12 inch in size of glass units.
- E. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience and approved by manufacturer.
- C. Installer Qualifications: A qualified installer who employs glass installers for this Project who are certified under the National Glass Association's Certified Glass Installer Program.

1.7 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 40 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.
- C. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 MANUFACTURERS: Subject to compliance with requirements, provide products by one of the following:

- A. Glass Fabricators:
 1. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
 2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
 3. Guardian Glass, LLC: www.guardinaglass.com.
 4. Oldcastle Building Envelope: www.obe.com.
 5. Pilkington North America, Inc; www.pilkington.com
 6. Vitro Architectural Glass: www.vitroglazings.com
- B. Source Limitations for Glass: Obtain from single source from single manufacturer for each glass type.
 1. Obtain tinted glass from single source from single manufacturer.
 2. Obtain reflective-coated glass from single source from single manufacturer.
- C. Source Limitations for Glazing Accessories: Obtain from single source from single manufacturer for each product and installation method.

2.2 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

- A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
 1. Design Pressure: Calculated in accordance with applicable codes and as indicated on Drawings.
 2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
 3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
 4. Differential Shading: Design glass to resist thermal stresses induced by differential shading within individual glass lites.
 5. Glass thicknesses listed are minimum.
- B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
 1. In conjunction with weather barrier related materials described in other sections, as follows:
- C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3 GLASS MATERIALS

- A. Float Glass: Provide float glass based glazing unless otherwise indicated.
 1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048, Kind HS and FT, Condition A, (uncoated) unless
 3. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
 4. Tinted Type: ASTM C1036, Class 2 - Tinted, Quality - Q3, with color and performance characteristics as indicated.
 5. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design.

2.4 INSULATING GLASS UNITS

- A. Manufacturers:
 1. Cardinal Glass Industries; <>: www.cardinalcorp.com/#sle.
 2. Guardian Glass, LLC; <>: www.guardianglass.com/#sle.
 3. Pilkington North America Inc; <>: www.pilkington.com/na/#sle.Pilkington North America Inc; <>: www.pilkington.com/na/#sle.
 4. Vitro Architectural Glass (formerly PPG Glass); <>: www.vitroglazings.com/#sle.
- B. Insulating Glass Units: Types as indicated.
 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
 3. Perimeter Spacers: Manufacturer's standard space material and construction.
 - a. Products: Subject to compliance with requirements, provide one of the following:
 - 1) Technoform Glass Insulation; TGI-Spacer: www.glassinsulation.us.
 - 2) Thermix; a brand of Ensigner USA; Thermix: www.thermix.de.
 4. Spacer Color: Black.
 5. Edge Seal:
 - a. Dual-Sealed System: Provide manufacturer's standard primary and secondary sealsants.
 6. Color: Black.
 7. Purge interpane space with dry air, hermetically sealed.

2.5 BASIS OF DESIGN - INSULATING GLASS UNITS

- A. Basis of Design - Insulating Glass Units: Vision glazing, with low-e coating.
 1. Applications: Exterior insulating glass glazing unless otherwise indicated.
 2. Space between lites filled with air.
 3. Total Thickness: 1 inch.
 4. Thermal Transmittance (U-Value), Winter - Center of Glass: 0.29, nominal.
 5. Visible Light Transmittance (VLT): 35 percent, nominal.
 6. Solar Heat Gain Coefficient (SHGC): 0.25, nominal.
 7. Visible Light Reflectance, Outside: 6 percent, nominal.
 8. Glazing Method: Dry glazing method, gasket glazing.
 9. Spacer Color: Black.
 10. Edge Seal:

- a. Single-Sealed System: Provide silicone sealant as seal applied around perimeter.
- 11. Color: Black.
- 12. Purge interpane space with dry air, hermetically sealed.
- 13. Basis of Design - Vitro Architectural Glass (formerly PPG Glass):
www.vitroglazings.com/#sle.
- 14. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
 - a. Low-E Coating: Vitro Architectural Glass (formerly PPG Glass) Solarban 60 on #3 surface.
 - b. Glass Tint: Solargray (light-gray).
- 15. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
 - a. Glass: Clear.

2.6 GLAZING UNIT SCHEDULE

- A. Monolithic Interior Vision Glazing:
 - 1. Applications: Interior glazing unless otherwise indicated.
 - 2. Glass Type: Heat-strengthened float glass.
 - 3. Tint: Clear.
 - 4. Thickness: 1/4 inch, nominal.
 - 5. Safety Glazing as indicated on Drawings.

2.7 GLAZING COMPOUNDS

- A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 100/50, Use NT ; with cured Shore A hardness range of 15 to 25; color as selected by Architect from manufacturer's full range.
- B. Manufacturers:
 - 1. BASF Corporation; <>: www.basf.com/us/en.html/#sle.
 - 2. Dow Corning Corporation; 790 Silicone Building Sealant: www.dowcorning.com/construction.
 - 3. Momentive Performance Materials, Inc; SCS2700 SilPruf LM: www.momentive.com.
 - 4. Pecora Corporation; 890NST: www.pecora.com.
 - 5. Sika Corporation; SikaSil WS-290: www.sika.com.
 - 6. Tremco Commercial Sealants & Waterproofing; Spectrum 1: www.tremcosealants.com.

2.8 ACCESSORIES

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, with requirements of manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.
- C. Setting Blocks: Elastomeric material with a Shore, Type A durometer hardness of 85, plus or minus 5.
- D. Spacers: Elastomeric blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
- E. Edge Blocks: Elastomeric material of hardness needed to limit glass lateral movement (side walking).
- F. Glazing Tape: Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
 - 1. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.
 - 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.
- G. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

- H. Glazing Clips: Manufacturer's standard type.
- I. Cylindrical Glazing Sealant Backing: ASTM C 1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

- A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.
- B. Verify that the minimum required face and edge clearances are being provided.
- C. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.
- D. Verify that sealing between joints of glass framing members has been completed effectively.
- E. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

- A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.
- B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.
- C. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.
- D. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.
- E. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.
- F. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

- A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 CLEANING

- A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove nonpermanent labels immediately after glazing installation is complete.
- C. Clean glass and adjacent surfaces after sealants are fully cured.
- D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.6 PROTECTION

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.
- B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 088719 - SECURITY GLAZING FILM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Glazing film applied to new glazing assemblies.

1.2 REFERENCE STANDARDS

- A. WEY-SA-C1 - Standard for shooter/attack certification and forced entry.
- B. GSA Level C - General Services Administration Standard Test Method for Glazing and Window Systems Subject to Dynamic Overpressure Loadings.
- C. EN356 P4 - Testing and Classification of Resistance Against Manual Attack.
- D. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials Current Edition.
- E. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test 2015 (Reaffirmed 2020).
- F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference 2014 (Reapproved 2021).
- G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- H. ASTM F1642/F1642M - Standard Test Method for Glazing and Glazing Systems Subject to Airblast Loadings 2017.
- I. UL 972 - Standard for Burglary Resisting Glazing Material Current Edition, Including All Revisions.

1.3 SUBMITTALS

- A. Test Reports: Detailed reports of full-scale chamber tests to specified criteria, using assemblies identical to those required for this project.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Record of product certifications for safety requirements.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Product Samples For each film product to be used provide one sample a minimum of 4 inches by 4 inches representing actual product, color, and pattern.

1.4 CLOSEOUT SUBMITTALS

- A. Warranty form filled out in Owner's name.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's un-opened packaging until ready for installation.
- B. Store and dispose of solvent-based materials and materials used with solvent-based materials in accordance with requirements of authority having jurisdiction.

1.6 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimal results. Do not install products under environmental conditions outside of manufacturer's absolute limits.

1.7 WARRANTY

- A. Provide 12 year manufacturer's replacement warranty covering film against peeling, cracking, discoloration, and deterioration.

PART 2 PRODUCTS

2.1 Clear microlayered safety and security window film

- A. Film to be applied at the back (on the interior side / opposite of attack face) side of glazing.
 - 1. Basis-of-Design: 3M Scotchshield Ultra S800 Safety and Security Film. Optically clear microlayered polyester film with a durable acrylic abrasion resistant coating over one surface and a pressure sensitive adhesive on the other. The adhesive is pressure-

activated, not water-activated, and forms a physical bond, not chemical bond, to the glass. The film is microlayered with both plastic and ductile polyester layers for tear resistance.

- a. Glazing Film: Transparent polyester film for permanent bonding to glass.
- b. Thickness: 0.008 inches (8 mils) minimum.
- c. Color: Clear
- d. Visible Light Transmittance: 87 percent when film is applied to 1/4 thick clear annealed glass.

B. Film to be applied at the front (protected face) side of glazing.

1. Basis-of-Design: 3M Scotchshield Ultra S70 Solar Safety Window Film. Optically clear polyester film, with a durable acrylic abrasion resistant coating over the surface and pressure sensitive adhesive on the other.
 - a. Glazing Film: Transparent polyester film for permanent bonding to glass.
 - b. Thickness: 0.007 inches (7 mils) minimum.
 - c. Color: Clear

2.2 Attachment system method

A. Impact Protection Adhesive (IPA).

1. Thickness: 0.008 inches (8 mils) minimum using a single layer film. Multi-layered film to achieve thickness is not permitted.
2. Color: Clear.
3. Construction: 3-ply laminate.
4. Adhesive Type: Pressure sensitive.
5. Tensile Strength: 28,500 psi minimum.
6. Breaking Strength: 615 lbs/inch minimum.
7. Elongation at Break 230% maximum.
8. Surface Burning Characteristics: Flame spread index of 25 minimum and smoke developed index of 450 maximum when tested in accordance with ASTM E84 (Class A).
9. Visible Light Transmittance: 87 percent when film is applied to 1/4 thick clear annealed glass.
10. Anchoring System: DOW 995 or GE SCS2000 SilPruf Structural Sealant with high impact styrene trim.

PART 3 EXECUTION

3.1 INSTALLERS

- A. Utilize installers trained and certified by film manufacturer in the application of the product.

3.2 EXAMINATION

- A. Field-Applied Film: Verify that the existing conditions are adequate for the proper application and performance of film.
- B. Verify that the glass is not cracked, chipped, broken, or damaged before installation.
- C. Verify that frames are securely anchored and free from defects before installation.

3.3 PREPARATION

- A. Clean glass to remove dust, dirt, paint, oil, grease, mildew, mold, or any other contaminants that could inhibit adhesion.
- B. Immediately prior to applying film, thoroughly wash glass with a neutral cleaning solution.
- C. Protect adjacent surfaces.
- D. Do not begin installation of film until substrates have been properly prepared.

3.4 INSTALLATION

- A. Install in accordance with manufacturer's instructions, without air bubbles, wrinkles, streaks, bands, thin spots, pinholes, or gaps as required to achieve specified performance.
- B. Accurately cut film with straight edges to required sizes allowing between a 1/16" to 1/8 gap at perimeter of glazed panel unless other required by anchorage method.

- C. Provide seamless installation unless limited by manufacturing. Do not provide overlapped installation.
- D. Clean glass and excess structural sealants from finished surfaces.
- E. Remove any labels or protective covers.

3.5 PROTECTION

- A. Protect installed products until completion of the project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 092116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Gypsum wallboard.
- F. Joint treatment and accessories.
- G. Textured finish system.

1.2 RELATED REQUIREMENTS

- A. Section 054000 - Cold-Formed Metal Framing: Structural steel stud framing.
- B. Section 061000 - Rough Carpentry: Building framing and sheathing.
- C. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- D. Section 078400 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- E. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.3 REFERENCE STANDARDS

- A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members 2012.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- D. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members 2015.
- E. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board 2017 (Reapproved 2022).
- F. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board 2004 (Reapproved 2020).
- G. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members 2018.
- H. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.
- I. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products 2020.
- J. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board 2020.
- K. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base 2019.
- L. ASTM C1396/C1396M - Standard Specification for Gypsum Board 2017.
- M. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels 2019.
- N. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels 2019, with Editorial Revision (2020).
- O. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber 2021.
- P. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements 2009 (Reapproved 2016).
- Q. ASTM E413 - Classification for Rating Sound Insulation 2022.
- R. GA-216 - Application and Finishing of Gypsum Panel Products 2021.
- S. GA-600 - Fire Resistance and Sound Control Design Manual 2021.

- T. ICC (IBC) - International Building Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

- A. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- B. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
 - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Sound-Rated: Provide completed assemblies with the following characteristics:
 - 1. Acoustic Attenuation: STC of 50-54 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies with the following characteristics:
 - 1. Fire Rated Partitions: UL listed assembly as indicated on Drawings.
 - 2. Fire Rated Shaft Walls: UL listed assembly as indicated on Drawings.
 - 3. Fire-Resistance-Rated Area Separation Walls: UL listed assembly as indicated on Drawings.
 - 4. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
 - 5. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
- D. STC-Rated Assemblies: Provide complete assemblies identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by and independent agency.

2.2 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
 - 1. ClarkDietrich; <>: www.clarkdietrich.com/#sle.
 - 2. Jaimes Industries; <>: www.jaimesind.com/#sle.
 - 3. Marino; <>: www.marinoware.com/#sle.
 - 4. R-stud, LLC; <>: www.rstud.com/#sle.
 - 5. Phillips Manufacturing Co; <>: www.phillipsmfg.com/#sle.
 - 6. SCAFCO Corporation; <>: www.scafco.com/#sle.
 - 7. Steel Construction Systems; <>: www.steelconsystems.com/#sle.
 - 8. Substitutions: See Section 016000 - Product Requirements.
- B. Structural Steel Framing for Application of Gypsum Board: As specified in Section 054000.
- C. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 7.5 psf.
 - 1. Studs: "C" shaped with knurled or embossed faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Ceiling Channels: C-shaped.
 - 4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
 - 5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.
 - a. Products:
 - 1) Same manufacturer as other framing materials.
 - 2) ClarkDietrich; RC Deluxe Resilient Channel: www.clarkdietrich.com/#sle.

- 3) Phillips Manufacturing Co; RC-2 Resilient Sound Channel:
www.phillipsmfg.com/#sle.
- 4) Substitutions: See Section 016000 - Product Requirements.
- D. Shaft Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.
- E. Area Separation Wall Studs and Accessories: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with specified performance requirements.
- F. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
 - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
 - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
 - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
 - 4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.
 - a. Products:
 - 1) FireTrak Corporation; Posi Klip.
 - 2) Metal-Lite, Inc; The System.
 - 3) Substitutions: See Section 016000 - Product Requirements.
 - 5. Deflection and Firestop Track:
 - 6. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- G. Non-structural Framing Accessories:
 - 1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
 - 2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
 - a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
 - b. Height: 35-3/4 inches.
 - c. Products:
 - 1) ClarkDietrich; Pony Wall (PW): www.clarkdietrich.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.
 - 3. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
 - a. Products:
 - 1) ClarkDietrich; FastBridge Clip (FB33): www.clarkdietrich.com/#sle.
 - 4. Flexible Wood Backing: Fire-retardant-treated wood with sheet steel connectors.
 - a. Products:
 - 1) ClarkDietrich; Danback: www.clarkdietrich.com/#sle.
 - 2) Substitutions: See Section 016000 - Product Requirements.

2.3 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum Company; <>: www.americangypsum.com/#sle.
 - 2. CertainTeed Corporation; <>: www.certainteed.com/#sle.
 - 3. Continental Building Products; <>: www.continental-bp.com/#sle.
 - 4. Georgia-Pacific Gypsum; <>: www.gpgypsum.com/#sle.

5. National Gypsum Company; <>: www.nationalgypsum.com/#sle.
 6. PABCO Gypsum; <>: www.pabco gypsum.com/#sle.
 7. USG Corporation; <>: www.usg.com/#sle.
 8. Substitutions: See Section 016000 - Product Requirements.
- B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
 2. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
 3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.
 - b. Ceilings: 5/8 inch.
 - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
 4. Paper-Faced Products:
 - a. American Gypsum Company; FireBloc Type X Gypsum Wallboard.
 - b. CertainTeed Corporation; Type X Drywall.
 - c. Continental Building Products; Firecheck Type X.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X.
 - e. Substitutions: See Section 016000 - Product Requirements.
 5. Mold Resistant Paper Faced Products:
 - a. American Gypsum Company; M-Bloc Type X.
 - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall.
 - c. Continental Building Products; Mold Defense Type X.
 - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard.
 - e. National Gypsum Company; Gold Bond XP Gypsum Board.
 - f. Substitutions: See Section 016000 - Product Requirements.
- C. Abuse Resistant Wallboard:
1. Application: High-traffic areas indicated.
 2. Surface Abrasion: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 3. Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 4. Soft Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 5. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 6. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
 7. Type: Fire-resistance-rated Type X, UL or WH listed.
 8. Thickness: 5/8 inch.
 9. Edges: Tapered.
 10. Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc AR Type X.
 - b. CertainTeed Corporation; Extreme Abuse Resistant Drywall with M2Tech.
 - c. Continental Building Products; Protecta AR 100 Type X with Mold Defense.
 - d. Continental Building Products; Rapid Deco Level 5 Type X with Protecta.
 - e. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold Guard Abuse-Resistant.
 - f. National Gypsum Company; Gold Bond Hi-Abuse XP Gypsum Board.
 - g. Substitutions: See Section 016000 - Product Requirements.
- D. Impact Resistant Wallboard:
1. Application: High-traffic areas indicated.
 2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.

3. Indentation: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
 4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 5. Hard Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
 6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 7. Paper-Faced Type: Gypsum wallboard, as defined in ASTM C1396/C1396M.
 8. Type: Fire-resistance-rated Type X, UL or WH listed.
 9. Thickness: 5/8 inch.
 10. Edges: Tapered.
 11. Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc IR Type X.
 - b. CertainTeed Corporation; Extreme Impact Resistant Drywall with M2Tech.
 - c. Continental Building Products; Protecta HIR 300 Type X with Mold Defense.
 - d. National Gypsum Company; Gold Bond Hi-Impact XP Gypsum Board.
 - e. Substitutions: See Section 016000 - Product Requirements.
- E. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
 2. Thickness: 1/2 inch.
 3. Edges: Tapered.
 4. Products:
 - a. CertainTeed Corporation; Interior Ceiling Drywall.
 - b. Continental Building Products; Sagcheck.
 - c. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board.
 - d. Substitutions: See Section 016000 - Product Requirements.
- F. Exterior Sheathing Board: As specified in Section 061000.
- G. Shaftwall and Coreboard: Type X; 1 inch thick by 24 inches wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
 2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
 4. Paper-Faced Products:
 - a. American Gypsum Company; M-Bloc Shaft Liner.
 - b. American Gypsum Company; Shaft Liner.
 - c. CertainTeed Corporation; M2Tech Type X Shaftliner.
 - d. Georgia-Pacific Gypsum; ToughRock Shaftliner.
 - e. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.
 - f. Substitutions: See Section 016000 - Product Requirements.
 5. Glass Mat Faced Products:
 - a. American Gypsum Company; M-Glass Shaft Liner.
 - b. CertainTeed Corporation; GlasRoc Shaftliner Type X.
 - c. Continental Building Products; Shaftliner Type X.
 - d. Continental Building Products; Mold Defense Shaftliner Type X.
 - e. Continental Building Products; Weather Defense Platinum Shaftliner Type X.
 - f. Georgia-Pacific Gypsum; DensGlass Shaftliner (mold-resistant).
 - g. National Gypsum Company; Gold Bond Brand eXP Shaftliner.
 - h. National Gypsum Company; Gold Bond Fire-Shield Shaftliner XP.

- i. Substitutions: See Section 016000 - Product Requirements.

2.4 Gypsum Wallboard ACCESSORIES

- A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 4 inch.
- B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
 - 1. Products:
 - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: www.titebond.com/#sle.
 - b. Liquid Nails, a brand of PPG Architectural Coatings; AS-825 Acoustical Sound Sealant: www.liquidnails.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.
 - 1. Types: As detailed or required for finished appearance.
 - 2. Special Shapes: In addition to conventional corner bead and control joints, provide U-bead, L-bead, and LC-bead at exposed panel edges.
- D. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
 - 1. Paper Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.
 - 2. Joint Compound: Drying type, vinyl-based, ready-mixed.
 - a. Products:
 - 1) CertainTeed Corporation; Extreme All-Purpose Joint Compound: www.certainteed.com/#sle.
 - 2) Continental Building Products; <>: www.continental-bp.com/#sle.
 - 3) Substitutions: See Section 016000 - Product Requirements.
- E. Finishing Compound: Surface coat and primer, takes the place of skim coating.
 - 1. Products:
 - a. CertainTeed Corporation; Quick Prep Plus Interior Prep Coat: www.certainteed.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- F. High Build Drywall Surfacers: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
 - 1. Products:
 - a. CertainTeed Corporation; Level V Wall and Ceiling Primer/Surfacer with M2Tech: www.certainteed.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- G. Textured Finish Materials: Latex-based compound; plain.
 - 1. Products:
 - a. CertainTeed Corporation; Extreme Texture Coat/Acrylic Texture with M2Tech: www.certainteed.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- H. Nails for Attachment to Wood Members: ASTM C514.
- I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION

- A. Shaft Wall Framing: Install in accordance with manufacturer's installation instructions.

1. Fasten runners to structure with short leg to finished side, using appropriate power-driven fasteners at not more than 24 inches on center.
 2. Install studs at spacing required to meet performance requirements.
- B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.
1. On walls over sixteen feet high, screw-attach studs to runners top and bottom.
 2. Seal perimeter of shaft wall and penetrations with acoustical sealant.

3.3 FRAMING INSTALLATION

- A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
1. Level ceiling system to a tolerance of 1/1200.
 2. Laterally brace entire suspension system.
 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches on center.
1. Extend partition framing as indicated in Drawings.
 2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
 3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
1. Orientation: Horizontal.
 2. Spacing: As indicated.
- F. Acoustic Furring: Install resilient channels at maximum 24 inches on center. Locate joints over framing members.
- G. Blocking: Install wood blocking for support of:
1. Framed openings.
 2. Wall-mounted cabinets.
 3. Plumbing fixtures.
 4. Toilet partitions.
 5. Toilet accessories.
 6. Wall-mounted door hardware.

3.4 ACOUSTIC ACCESSORIES INSTALLATION

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
1. Place one bead continuously on substrate before installation of perimeter framing members.
 2. Place continuous bead at perimeter of each layer of gypsum board.
 3. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.5 BOARD INSTALLATION

- A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

- B. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
 - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- D. Installation on Metal Framing: Use screws for attachment of gypsum board.
- E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
 - 1. Single-Layer Applications: Screw attachment.

3.6 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
 - 1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.7 JOINT TREATMENT

- A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
 - 3. Level 3: Walls to receive textured wall finish.
 - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
 - 5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
 - 6. Level 0: Temporary partitions.
 - 7. Level 0: Surfaces indicated to be finished in later stage of project.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
 - 2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
 - 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.8 TEXTURE FINISH

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

3.9 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 093000 - TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Cementitious backer board as tile substrate.
- D. Ceramic trim.
- E. Non-ceramic trim.

1.2 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

1.3 REFERENCE STANDARDS

- A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium) 2019.
- B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar 2017.
- C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 2017.
- D. ANSI A108.1c - Contractor's Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar 1999 (Reaffirmed 2021).
- E. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesive or Water Cleanable Tile-Setting Epoxy Adhesive 2019.
- F. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar 2021.
- G. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grout Epoxy 1999 (Reaffirmed 2019).
- H. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout 1999 (Reaffirmed 2019).
- I. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout 1999 (Reaffirmed 2019).
- J. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework 2017.
- K. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units 2018.
- L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar 1999 (Reaffirmed 2019).
- M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2005 (Reaffirmed 2021).
- N. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar 2019.
- O. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation 2019.
- P. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units 2019.
- Q. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone 2014 (Reaffirmed 2019).

- R. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation 2014 (Reaffirmed 2019).
- S. ANSI A137.1 - American National Standard Specifications for Ceramic Tile 2022.
- T. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring 2022.
- U. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride 2022.
- V. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Samples: Mount tile and apply grout on two plywood panels, minimum 36 by 36 inches in size illustrating pattern, color variations, and grout joint size variations.
- D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Tile: 10 square feet of each size, color, and surface finish combination.
 - 3. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

1.6 QUALITY ASSURANCE

- A. Maintain one copy of and ANSI A108/A118/A136 and TCNA (HB) on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.
- C. Installer Qualifications:
 - 1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.7 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
 - 1. Minimum size of mock-up is indicated on drawings. Mock ups to include wall and floor tile.
 - 2. Approved mock-up may remain as part of the Work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Maintain ambient and substrate temperature of 50 degrees F during installation of mortar materials.

PART 2 PRODUCTS

2.1 TILE

- A. Manufacturers: _____
 - 1. American Olean Corporation: www.americanolean.com/#sle.
 - 2. Dal-Tile Corporation: www.daltile.com/#sle.
 - 3. Emser Tile, LLC: www.emser.com/#sle.
 - 4. Terrazzo & Marble Supply Companies: www.tmsupply.com/#sle.

5. Fiandre Architectural Surfaces www.granitifiandre.com
 6. Landmark Ceramics www.landmarkceramics.com
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Ceramic Tile: ANSI A137.1 standard grade.
1. Size: As indicated on Drawings.
 2. Color(s): As indicated on Drawings.
 3. Pattern: As indicated on Drawings.
 4. Products: As indicated on Drawings.
- C. Porcelain Tile: ANSI A137.1 standard grade.
1. Size: As indicated on Drawings.
 2. Color(s): As indicated on drawings.
 3. Pattern: As indicated on Drawings..
 4. Products: As indicated on Drawings.

2.2 TRIM AND ACCESSORIES

- A. Ceramic Trim: Matching bullnose, double bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
1. Applications:
 - a. Open Edges: Bullnose.
 - b. Inside Corners: Jointed.
 - c. Floor to Wall Joints: Cove base.
 2. Manufacturers: Same as for tile.
- B. Non-Ceramic Trim: Satin brass anodized extruded aluminum, style and dimensions to suit application, for setting using tile mortar or adhesive.
1. Applications:
 - a. Open edges of wall tile.
 - b. Open edges of floor tile.
 - c. Wall corners, outside and inside.
 - d. Transition between floor finishes of different heights.
 - e. Floor to wall joints.
 - f. Borders and other trim as indicated on drawings.
 2. Manufacturers:
 - a. Schluter-Systems: www.schluter.com/#sle.
 - b. Genesis APS International: www.genesis-aps.com/#sle.

2.3 SETTING MATERIALS

- A. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
1. Applications: Use this type of bond coat where indicated and where no other type of bond coat is indicated.
 2. Products:
 - a. ARDEX Engineered Cements; ARDEX N 23 MICROTEC: www.ardexamericas.com/#sle.
 - b. Custom Building Products; ProLite Premium Rapid Setting Large Format Tile Mortar, with Multi-Surface Bonding Primer: www.custombuildingproducts.com/#sle.
 - c. TEC, an H.B. Fuller Construction Products Brand; TEC Ultimate Large Tile Mortar: www.tecspecialty.com/#sle.

2.4 GROUTS

- A. Standard Grout: ANSI A118.6 standard cement grout.
1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.

2. Use sanded grout for joints 1/8 inch wide and larger; use unsanded grout for joints less than 1/8 inch wide.
 3. Color(s): As indicated on drawings.
 4. Products: Subject to compliance with requirements provide products by one of the following:
 - a. Custom Building Products; Polyblend Non-Sanded Grout: www.custombuildingproducts.com/#sle.
 - b. LATICRETE International, Inc; LATICRETE 1500 Sanded Grout: www.laticrete.com/#sle.
 - c. Mapei Corporation www.mapei.com
- B. Stain Resistant Grout Additive: Liquid admixture for sanded and unsanded cement-based grouts; mix with dry grout material in place of water.
1. Applications: all grout applications.

2.5 Maintenance Materials

- A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
1. Applications: Between tile and plumbing fixtures.
 2. Color(s): As selected by Architect from manufacturer's full line.
 3. Products: Subject to compliance with requirements, provide products by one of the following:
 - a. ARDEX Engineered Cements; ARDEX SX: www.ardexamericas.com/#sle.
 - b. Custom Building Products; Commercial 100% Silicone Caulk: www.custombuildingproducts.com/#sle.
 - c. LATICRETE International, Inc; LATICRETE LATASIL: www.laticrete.com/#sle.
- B. Grout Sealer: Liquid-applied, moisture and stain protection for existing or new Portland cement grout.
1. Composition: Water-based colorless silicone.
 2. Products: Subject to compliance with requirements, provide products by one of the following:
 - a. Merkrete, by Parex USA, Inc; Merkrete Grout Sealer: www.merkrete.com/#sle.

2.6 ACCESSORY MATERIALS

- A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
1. Crack Resistance: No failure at 1/8 inch gap, minimum.
 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber, Synthetic rubber, Acrylic, or Acrylic.
 - b. Thickness: 20 mils, maximum.
 - c. Products:
 - 1) LATICRETE International, Inc; LATICRETE Blue 92 Anti-Fracture Membrane: www.laticrete.com/#sle.
 - 2) Merkrete, by Parex USA, Inc; Merkrete Fracture Guard: www.merkrete.com/#sle.
- B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
1. Crack Resistance: No failure at 1/16 inch gap, minimum; comply with ANSI A118.12.
 2. Fluid or Trowel Applied Type:
 - a. Material: Synthetic rubber or Acrylic.
 - b. Thickness: 25 mils, minimum, dry film thickness.
 - c. Products:
 - 1) ARDEX Engineered Cements; ARDEX 8+9: www.ardexamericas.com/#sle.

- 2) Custom Building Products; RedGard Crack Prevention and Waterproofing Membrane: www.custombuildingproducts.com/#sle.
 - 3) TEC, an H.B. Fuller Construction Products Brand; TEC HydraFlex Waterproofing Crack Isolation Membrane: www.tecspecialty.com/#sle.
 - 4) LATICRETE International, Inc; LATICRETE HYDRO BAN: www.laticrete.com/#sle.
- C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch thick; 2 inch wide coated glass fiber tape for joints and corners.
1. Products:
 - a. Custom Building Products; WonderBoard Lite Backerboard: www.custombuildingproducts.com/#sle.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:
 1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
 2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.
- E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.
- E. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION - GENERAL

- A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.13, manufacturer's instructions, and TCNA (HB) recommendations.
- B. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- C. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- D. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

- E. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- F. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.
- G. Form internal angles square and external angles bullnosed.
- H. Install ceramic accessories rigidly in prepared openings.
- I. Install non-ceramic trim in accordance with manufacturer's instructions.
- J. Sound tile after setting. Replace hollow sounding units.
- K. Keep control and expansion joints free of mortar, grout, and adhesive.
- L. Prior to grouting, allow installation to completely cure; minimum of 48 hours.
- M. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.
- N. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

- A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
 - 1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
- B. Over wood substrates, install in accordance with TCNA (HB) Method F142, with standard grout, unless otherwise indicated.
- C. Over wood substrate with backer board underlayment, install in accordance with TCNA (HB) Method F144, for cementitious backer boards, with standard grout.

3.5 INSTALLATION - WALL TILE

- A. On exterior walls install in accordance with TCNA (HB) Method W244, thin-set over cementitious backer units, with waterproofing membrane.
- B. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms.
- C. Over interior concrete and masonry install in accordance with TCNA (HB) Method W202, thin-set with dry-set or latex-Portland cement bond coat.

3.6 CLEANING

- A. Clean tile and grout surfaces.

3.7 PROTECTION

- A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 095100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

1.2 REFERENCE STANDARDS

- A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings 2022.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels 2019.
- C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions 2022.
- D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products 2022.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Do not install acoustical units until after interior wet work is dry.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.6 FIELD CONDITIONS

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acoustic Tiles/Panels:
 - 1. Armstrong World Industries, Inc; <>: www.armstrong.com/#sle.
 - 2. CertainTeed Corporation; <>: www.certainteed.com/#sle.
 - 3. USG; <>: www.usg.com/#sle.
 - 4. Chicago Metallic.
 - 5. Rockfon.
 - 6. Substitutions: See Section 016000 - Product Requirements.
- B. Suspension Systems:
 - 1. Same as for acoustical units.

2.2 ACOUSTICAL UNITS

- A. Acoustical Units - General: ASTM E1264, Class A.
- B. Acoustical Tile Type ACT1: Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:
 - 1. Basis of Design Product: USG Radar ClimaPlus High-NRC/High-CAC
 - 2. Size: 24 by ___ inches 24"x24".
 - 3. Thickness: 3/4" inches.
 - 4. Light Reflectance: 0.84 percent, determined in accordance with ASTM E1264.
 - 5. NRC Range: 0.70 to _____, determined in accordance with ASTM E1264.
 - 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.

7. Edge: Square.
 8. Surface Color: White.
- C. Glass Fiber Acoustical Panels Type ACT2: Vinyl faced glass fiber ASTM E1264 Type X with the following characteristics:
1. Basis of Design Product: USG Climaplus Clean Room
 2. Size: 24 by 24 inches.
 3. Thickness: 5/8 inches.
 4. Light Reflectance: 0.79 percent, determined in accordance with ASTM E1264.
 5. NRC Range: 0.55 to 0.55, determined in accordance with ASTM E1264.
 6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
 7. Edge: Square.
 8. Surface Color: White.
 9. Surface Pattern: Perforated, small holes.
- D. Gypsum Ceiling Board: See Section 092116 - Gypsum Board Assemblies.

2.3 SUSPENSION SYSTEM(S)

- A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- B. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; heavy-duty.
1. Profile: Tee; 15/16 inch wide face.
 2. Finish: White painted.
- C. Metal Perimeter System: Pre-finished, extruded aluminum trim.
1. Products:
 - a. FORMATIONS - Armstrong Ceiling Solutions.
 - b. Substitutions: See Section 016000 - Product Requirements.
 2. Profile: Drywall grid; 1-1/2 inch suspension system.
 3. Trim: Axiom Vector - Armstrong Ceiling Solutions
 4. Trim Height: as indicated on Drawings.
 5. Trim Color: as indicated on Drawings.

2.4 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Acoustical Insulation: ASTM C665 friction fit type, unfaced batts.
1. Thickness: 2 inch.
 2. Size: To fit acoustical suspension system.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - SUSPENSION SYSTEM

- A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.
- B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.
- C. Locate system on room axis according to reflected plan.

- D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.
- E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- F. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.
- J. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
 - 1. Use longest practical lengths.
 - 2. Overlap and rivet corners.

3.3 INSTALLATION - ACOUSTICAL UNITS

- A. Install acoustical units in accordance with manufacturer's instructions.
- B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.
- C. Fit border trim neatly against abutting surfaces.
- D. Install units after above-ceiling work is complete.
- E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.
- F. Cutting Acoustical Units:
 - 1. Make field cut edges of same profile as factory edges.
- G. Lay acoustical insulation for a distance of 48 inches either side of acoustical partitions as indicated.
- H. Install hold-down clips on panels within 20 ft of an exterior door.

3.4 TOLERANCES

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 096500 - RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Resilient base.
- B. Resilient stair accessories.
- C. Installation accessories.

1.2 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.3 REFERENCE STANDARDS

- A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source 2019a, with Editorial Revision (2020).
- B. ASTM F1859 - Standard Specification for Rubber Sheet Floor Covering Without Backing 2021a.
- C. ASTM F1861 - Standard Specification for Resilient Wall Base 2021.
- D. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing 2019.
- E. ASTM F2169 - Standard Specification for Resilient Stair Treads 2015 (Reapproved 2020).
- F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 2023.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- D. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Flooring Material: 100 square feet of each type and color or 10%, whichever is greater.
 - 3. Extra Wall Base: 10 linear feet of each type and color, or 10%, whichever is greater.
 - 4. Extra Stair Materials: Quantity equivalent to 5 percent of each type and color.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.
- B. Store all materials off of the floor in an acclimatized, weather-tight space.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Protect roll materials from damage by storing on end.
- E. Do not double stack pallets.

1.6 FIELD CONDITIONS

- A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

3.1 SHEET FLOORING

- A. Vinyl Sheet Flooring - Type ____: Homogeneous without backing, with color and pattern throughout full thickness.
 - 1. Minimum Requirements: Comply with ASTM F1913.

2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 3. Thickness: 0.080 inch nominal.
 4. Seams: Heat welded.
 5. Integral coved base with cap strip.
 6. Pattern: As indicated on drawings.
 7. Color: As indicated on drawings.
- B. Rubber Sheet Flooring - Type ____: 100 percent rubber composition, color and pattern through total thickness.
1. Minimum Requirements: Comply with ASTM F1859, Type 1, without backing.
 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
 3. Thickness: 0.125 inch minimum.
 4. Seams: Heat welded.
 5. Surface Texture: Smooth.
 6. Pattern: As indicated on drawings.
 7. Color: As indicated on drawings.
- C. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color matching field color.

3.2 STAIR COVERING

- A. Stair Treads: Vinyl; full width and depth of stair tread in one piece; tapered thickness.
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Burke Flooring; Endura Stair Treads: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company; ____: www.johnsonite.com/#sle.
 - c. Roppe Corp; ____: www.roppe.com/#sle.
 2. Minimum Requirements: Comply with ASTM F2169, Type TV, vinyl, thermoplastic.
 3. Color: As indicated on drawings.
- B. Stair Nosings: 1-1/2 inch horizontal return, 1-1/8 inch vertical return, full width of stair tread in one piece.
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Burke Flooring; Ascend Stair Nosings: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company; <>: www.johnsonite.com/#sle.
 - c. Roppe Corp; <>: www.roppe.com/#sle.
 2. Material: Vinyl.
 3. Color: As indicated on drawings.

3.3 RESILIENT BASE

- A. Resilient Base: ASTM F1861, Type TV, vinyl, thermoplastic; top set Style B, Cove.
1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Burke Flooring: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company; <>: www.johnsonite.com/#sle.
 - c. Roppe Corp; <>: www.roppe.com/#sle.
 2. Height: As indicated on Drawings.
 3. Length: Roll 120 feet.
 4. Color: As indicated on drawings.

3.4 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

- B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
- C. Moldings, Transition and Edge Strips: Same material as flooring.
 - 1. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - a. Burke Flooring; ____: www.burkeflooring.com/#sle.
 - b. Johnsonite, a Tarkett Company; ____: www.johnsonite.com.
 - c. Roppe Corp; ____: www.roppe.com.

PART 3 EXECUTION

4.1 EXAMINATION

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Verify that required floor-mounted utilities are in correct location.

4.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.

4.3 Installation - General

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install in accordance with manufacturer's written instructions.

4.4 Installation - Resilient Base

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

4.5 Installation - Stair Coverings

- A. Install stair coverings in one piece for full width and depth of tread.
- B. Adhere over entire surface. Fit accurately and securely.

4.6 CLEANING

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

4.7 PROTECTION

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 096813 - TILE CARPETING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Carpet tile, fully adhered.

1.2 RELATED REQUIREMENTS

- A. Section 090561 - Common Work Results for Flooring Preparation: Independent agency testing of concrete slabs, removal of existing floor coverings, cleaning, and preparation.

1.3 REFERENCE STANDARDS

- A. ASTM D2859 - Standard Test Method for Ignition Characteristics of Finished Textile Floor Covering Materials 2016 (Reapproved 2021).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.
- C. Shop Drawings: Indicate layout of joints.
- D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.
- E. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and _____.
- F. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.5 Warranty

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing specified carpet tile with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.7 FIELD CONDITIONS

- A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Tile Carpeting: Subject to compliance with requirements provide products by one of the following:
 - 1. Interface, Inc; <>: www.interfaceinc.com/#sle.
 - 2. Milliken & Company; <>: www.milliken.com/#sle.
 - 3. Tandus; <>: www.tandus.com/#sle.
 - 4. J&J Flooring Group, LLC www.jjflooringgroup.com
 - 5. Shaw Industries Group, Inc. www.shawcontract.com

2.2 MATERIALS

- A. Tile Carpeting, Type <> : <>
 - 1. Product Line: As indicated on Drawings.
 - 2. Size: As indicated on Drawings.
 - 3. Color: As indicated on Drawings.

4. Pattern: As indicated on Drawings..
5. Surface Flammability Ignition: Pass ASTM D2859 (the "pill test").

2.3 ACCESSORIES

- A. Sub-Floor Filler: White premix latex; type recommended by flooring material manufacturer.
- B. Adhesives:
 1. Compatible with materials being adhered; maximum VOC content of 50 g/L; CRI (GLP) certified; in lieu of labeled product, independent test report showing compliance is acceptable.
- C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that sub-floor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive carpet tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to sub-floor surfaces.
- D. Cementitious Sub-floor Surfaces: Verify that substrates are dry enough and ready for flooring installation by testing for moisture and pH.
 1. Test in accordance with Section 090561.
 2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

- A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.
- B. Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler.
- C. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.
- D. Vacuum clean substrate.

3.3 INSTALLATION

- A. Starting installation constitutes acceptance of sub-floor conditions.
- B. Install carpet tile in accordance with manufacturer's instructions.
- C. Blend carpet from different cartons to ensure minimal variation in color match.
- D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.
- E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.
- F. Locate change of color or pattern between rooms under door centerline.
- G. Fully adhere carpet tile to substrate.
- H. Trim carpet tile neatly at walls and around interruptions.
- I. Complete installation of edge strips, concealing exposed edges.

3.4 CLEANING

- A. Remove excess adhesive without damage, from floor, base, and wall surfaces.
- B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 098430 - SOUND-ABSORBING WALL AND CEILING UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Sound-absorbing panels.
- B. Mounting accessories.

1.2 RELATED REQUIREMENTS

- A. Section 095100 - Acoustical Ceilings: Ceiling suspension system.

1.3 REFERENCE STANDARDS

- A. ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method 2022.
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- C. ASTM E795 - Standard Practices for Mounting Test Specimens During Sound Absorption Tests 2023.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed data sheets for products specified.
- C. Shop Drawings: Fabrication and installation details, panel layout, and fabric orientation.
- D. Verification Samples: Fabricated samples of each type of panel specified; 12 by 12 inch, showing construction and edge details.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Panels: Quantity equal to 5 percent of total installed, but not less than one of each type.
 - a. Provide complete assembly, including mounting devices.
 - 3. Fabric: For each fabric, color, and pattern installed furnish length equal to 10 percent of amount installed but not fewer than 10 yards.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company with not less than five years of experience in manufacturing acoustical products similar to those specified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect acoustical units from moisture during shipment, storage, and handling. Deliver in factory-wrapped bundles; do not open bundles until units are needed for installation.
- B. Store units flat, in dry, well-ventilated space; do not stand on end.
- C. Protect edges from damage.

PART 2 PRODUCTS

2.1 WOOD VENEER SOUND-ABSORBING UNITS

- A. Manufacturers:
 - 1. TerraMai; Grille Slat: www.terramai.com.
 - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Wood Veneer Acoustical Panels for Walls: Medium Density Fiberboard (MDF) core panels with prime grade finished face veneer and non-woven acoustic material adhered to back of panel. Basis-of-design to be TerraMai, Grille Slat.

1. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
2. Noise Reduction Coefficient (NRC): 0.92 to 0.95 when tested in accordance with ASTM C423 for Type A mounting, per ASTM E795.
3. Acoustic Back-Up Material: Compressed fiberglass board, 1.5 lbs/cu ft density, in sizes to fit furring applications.
 - a. Thickness: 2 inch.
4. Panel Size: As indicated on drawings.
5. Mounting: Use fixing clips to attach to furring strips anchored to wall substrate.
 - a. Edge Profile: Square.

2.2 FABRICATION

- A. Factory-applied finishes on wood veneer panels to be uniform, smooth, and without blemishes.

2.3 ACCESSORIES

- A. Back-Mounting Accessories: Manufacturer's standard accessories for concealed support, designed to allow panel removal:
- B. Fixing Clips: Manufacturers standard for application as indicated.
- C. Furring Strips: as recommended by manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of acoustical units. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install acoustical units in locations as indicated, following manufacturer's installation instructions.
- B. Align panels accurately, with edges plumb and top edges level. Scribe to fit accurately at adjoining work and penetrations.
- C. Furring Mounted Wood Veneer Panels:
 1. Install furring strip along meeting edges of adjacent panels to ensure they are attached to same furring strip along abutted edge; 24 inch on center, maximum.
 2. Install acoustic back-up material between furring as required for application.
 3. Adhere first panel from edge to furring strip, and attach subsequent panels using fixing clips.
- D. Install acoustical units to construction tolerances of plus or minus 1/16 inch for the following:
 1. Plumb and level.
 2. Flatness.
 3. Width of joints.

3.3 CLEANING

- A. Clean fabric facing upon completion of installation from dust and other foreign materials, following manufacturer's instructions.

END OF SECTION

SECTION 099113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:
 - 1. Exposed surfaces of steel lintels and ledge angles.
 - 2. Mechanical and Electrical:
 - a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Non-metallic roofing and flashing.
 - 6. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.
 - 7. Marble, granite, slate, and other natural stones.
 - 8. Floors, unless specifically indicated.
 - 9. Ceramic and other types of tiles.
 - 10. Brick, glass unit masonry, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 11. Exterior insulation and finish system (EIFS).
 - 12. Glass.
 - 13. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Shop-primed items.
- B. Section 099123 - Interior Painting.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- B. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association Current Edition.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning 2007.
- G. SSPC-SP 13 - Surface Preparation of Concrete 2018.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 2. MPI product number (e.g. MPI #47).
 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.7 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 5 feet long by 3 feet wide, illustrating paint color, texture, and finish.
- C. Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
 2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:

1. Behr Process Corporation; <>: www.behr.com/#sle.
2. PPG Paints; <>: www.ppgpaints.com/#sle.
3. Rodda Paint Company; <>: www.roddapaint.com/#sle.
4. Sherwin-Williams Company; <>: www.sherwin-williams.com/#sle.

C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.
2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
4. Supply each paint material in quantity required to complete entire project's work from a single production run.
5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

C. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.3 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood, and primed metal.

1. Two top coats and one coat primer.
2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.
 - a. Products:
 - 1) PPG Paints Speedhide Exterior Latex Satin, 6-2045XI Series. (MPI #15)
 - 2) Sherwin-Williams Resilience, Satin. (MPI #15)
3. Top Coat(s): Exterior Alkyd Enamel; MPI #94 or 96.
 - a. Products:
 - 1) PPG Paints Interior/Exterior Industrial Enamel, Gloss, 7-282. (MPI #96)
 - 2) PPG Paints Fast Dry 35 Quick Drying Enamel, Gloss, 95-9000.
 - 3) Rodda Porsalite, Semi-Gloss, 745001. (MPI #94)
4. Primer: As recommended by top coat manufacturer for specific substrate.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.

- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 - 1. Fiber Cement Siding: 12 percent.
 - 2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 - 3. Exterior Wood: 15 percent, measured in accordance with ASTM D4442.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Masonry:
 - 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
 - 2. Prepare surface as recommended by top coat manufacturer.
- I. Fiber Cement Siding: Remove dirt, dust and other foreign matter with a stiff fiber brush. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
- J. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- K. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- L. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- M. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior caulking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- N. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- C. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099123 - INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
 - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
 - 6. Marble, granite, slate, and other natural stones.
 - 7. Floors, unless specifically indicated.
 - 8. Ceramic and other tiles.
 - 9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.
 - 10. Glass.
 - 11. Acoustical materials, unless specifically indicated.
 - 12. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

- A. Section 055000 - Metal Fabrications: Shop-primed items.
- B. Section 099113 - Exterior Painting.

1.3 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications 2019.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating 2005 (Reapproved 2017).
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials 2020.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual Current Edition.
- E. SSPC-SP 1 - Solvent Cleaning 2015, with Editorial Revision (2016).
- F. SSPC-SP 6 - Commercial Blast Cleaning 2007.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
- C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.
 - 1. Where sheen is specified, submit samples in only that sheen.

- D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.
 3. Label each container with color in addition to the manufacturer's label.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.7 MOCK-UP

- A. See Section 014000 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 3 feet long by 5 feet wide, illustrating paint color, texture, and finish.
- C. Locate where directed by Architect.
- D. Mock-up may remain as part of the work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.9 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 1. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
 2. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
 1. Behr Process Corporation: www.behr.com/#sle.
 2. PPG Paints: www.ppgpaints.com/#sle.
 3. Sherwin-Williams Company: www.sherwin-williams.com/#sle.
- C. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties,

- and capable of drying or curing free of streaks or sags.
- 2. Supply each paint material in quantity required to complete entire project's work from a single production run.
- 3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- C. Colors: As indicated on drawings.
 - 1. Extend colors to surface edges; colors may change at any edge as directed by Architect.
 - 2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

2.3 PAINT SYSTEMS - INTERIOR

- A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, brick, wood, plaster, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
 - a. Products:
 - 1) Sherwin-Williams ProMar 200 HP Series, Eg-Shel. (MPI #145)
 - 2) Sherwin-Williams ProMar 200 Zero VOC Interior Latex, Flat.
 - 3. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen for ceilings and other overhead surfaces.
 - b. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
 - 1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
 - 2. Two top coats and one coat primer.
 - 3. Top Coat(s): High Performance Architectural Interior Latex; MPI #139, 140, or 141.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
 - 4. Top Coat Sheen:
 - a. Satin: MPI gloss level 4; use this sheen at all locations.
 - 5. Primer: As recommended by top coat manufacturer for specific substrate.
- C. Paint I-OP-MD-WC - Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and aluminum.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, or 141.
 - a. Products:
 - 1) Sherwin-Williams Pro Industrial Pre-Catalyzed Waterbased Epoxy, Eg-Shel. (MPI #139)
 - 3. Top Coat Sheen:
 - a. Eggshell: MPI gloss level 3; use this sheen at all locations.
 - 4. Primer: As recommended by top coat manufacturer for specific substrate.
- D. Paint I-OP-DF - Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications,

galvanized ducts, galvanized conduit, galvanized piping, and _____.

1. Shop primer by others.
 2. One top coat <>.
 3. Top Coat: Latex Dry Fall; MPI #118, 155, or 226.
 - a. Products:
 - 1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)
 4. Top Coat Sheen:
 - a. Flat: MPI gloss level 1; use this sheen at all locations.
- E. Paint I-OP-FL - Concrete and Wood Floors to be Painted.
1. Two top coats and one coat primer.
 2. Top Coat(s): Alkyd Floor Enamel, Gloss; MPI #27.
 - a. Products:
 - 1) PPG Paints Floor and Porch Enamel WB Alkyd, 3-610 Series, Gloss.

2.4 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin application of paints and finishes until substrates have been properly prepared.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.
- D. Test shop-applied primer for compatibility with subsequent cover materials.
- E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:
 1. Gypsum Wallboard: 12 percent.
 2. Plaster and Stucco: 12 percent.
 3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
 4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
 5. Concrete Floors and Traffic Surfaces: 8 percent.

3.2 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 2. Clean concrete according to ASTM D4258. Allow to dry.
- H. Masonry:
 1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written

- instructions. Allow to dry.
- 2. Prepare surface as recommended by top coat manufacturer.
- I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- L. Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.
- M. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- N. Copper: Remove contamination by steam, high pressure water, or solvent washing.
- O. Galvanized Surfaces:
 - 1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
- P. Ferrous Metal:
 - 1. Solvent clean according to SSPC-SP 1.
 - 2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
 - 3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.
- Q. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- R. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.3 APPLICATION

- A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 101400 - SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Room and door signs.
- B. Interior directional and informational signs.
- C. Cast dimensional characters.
- D. Cutout dimensional characters.
- E. Fabricated channel dimensional characters.
- F. Illuminated, fabricated channel dimensional characters.
- G. Building identification signs.
- H. Metal plaques.
- I. Panel signs.

1.2 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines current edition.
- B. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.3 COORDINATION

- A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.
- B. Furnish templates for placement of sign-anchorage devices embedded in permanent construction by other installers.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
 - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
 - 2. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, any exposed accessories, and method of attachment.
- E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.
- F. Verification Samples: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Dimensional Characters: [Full-size Sample] [Half-size Sample] of each type of dimensional character.
 - 2. Exposed Accessories: [Full-size Sample] [Half-size Sample] of each accessory type.
- G. Show signage mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
- H. Sample Warranty: For special warranty.
- I. Delegated-Design Submittal: For [signs indicated in "Performance Requirements" Article] .
 - 1. Include structural analysis calculations for signs indicated to comply with design loads; signed and sealed by the qualified professional engineer responsible for their

preparation.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: [Manufacturer of products] [An entity that employs installers and supervisors who are trained and approved by manufacturer].

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

1.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signage that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from Substantial Completion.

1.9 FIELD CONDITIONS

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in [the USDOJ's "2010 ADA Standards for Accessible Design"] [the ABA standards of the Federal agency having jurisdiction] [and] [ICC A117.1] .
- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design sign structure and anchorage of [rooftop] [dimensional character] sign type(s) according to structural performance requirements.
- C. Structural Performance: Signs and supporting elements shall withstand the effects of gravity and other loads within limits and under conditions indicated.
 - 1. Uniform Wind Load: [As indicated on Drawings] < Insert design load>.
 - 2. Concentrated Horizontal Load: [As indicated on Drawings] < Insert design load>.
 - 3. Other Design Load: [As indicated on Drawings] < Insert design load>.
 - 4. Uniform and concentrated loads need not be assumed to act concurrently.
- D. Thermal Movements: For exterior [fabricated channel dimensional characters] < Insert item>, allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: [120 deg F, ambient; 180 deg F, material surfaces] < Insert temperature change>.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 MANUFACTURERS

- A. Panel Signs: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
 - 1. Best Sign Systems, Inc; <>: www.bestsigns.com/#sle.
 - 2. Cosco Industries (ADA signs); ADA Series 1: www.coscoarchitecturalsigns.com/#sle.
 - 3. FASTSIGNS; <>: www.fastsigns.com/#sle.
 - 4. Inpro; <>: www.inprocorp.com/#sle.

5. Mohawk Sign Systems, Inc; <>: www.mohawksign.com/#sle.
 6. Seton Identification Products; <>: www.seton.com/aec/#sle.
 7. Signs & Decal Corp.
 8. Vista System
- B. Dimensional Letter Signs:
1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
 2. FASTSIGNS; <>: www.fastsigns.com/#sle.
 3. Inpro; <>: www.inprocorp.com/#sle.
- C. Plaques:
1. Cosco Industries; Cast Aluminum: www.coscoarchitecturalsigns.com/#sle.
 2. FASTSIGNS; <>: www.fastsigns.com/#sle.

2.3 SIGNAGE APPLICATIONS

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 <>, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
1. Sign Type: Flat signs with applied character panel media as specified.
 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
 3. Character Height: 1 inch.
 4. Sign Height: 3 inches, unless otherwise indicated.
 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings.
 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
 8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", and braille.
- C. Interior Directional and Informational Signs:
1. Sign Type: Same as room and door signs.
- D. Building Identification Signs:
1. Use individual metal letters.
 2. Mount on outside wall in location indicated on drawings.
- E. Other Dimensional Letter Signs: Wall-mounted.
- F. Plaque: See Allowance for details.

2.4 SIGN TYPES

- A. Flat Signs: Signage media without frame.
1. Edges: Square.
 2. Corners: Square.
 3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
 2. Character Case: Upper case only.
 3. Background Color: As selected by Architect from manufacturer full line of colors..
 4. Character Color: Contrasting color. As selected by Architect.

2.5 TACTILE SIGNAGE MEDIA

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/16 inch.

- B. Applied Character Panels: Acrylic plastic base, with applied acrylic plastic letters and braille.
 1. Total Thickness: 1/8 inch.
 2. Letter Thickness: 1/8 inch.
 3. Letter Edges: Square.

2.6 PLAQUES

- A. Cast Plaque: Cast-metal plaque with background texture, border, and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 1. Plaque Material: Cast [aluminum] [brass] [bronze] [zinc] .
 2. Plaque Thickness: As indicated on Drawings.
 3. Size: _____ inches by _____ inches.
 4. Text and Typeface:
 - a. Character Font: Helvetica, Arial, or other sans serif font.
 - b. Character Color: Contrast with background color.
 5. Border Style: As indicated on drawings.
 6. Background Texture: Ripple.
 7. Surface Finish: Brushed, satin.
 8. Painted Background Color: Light oxide stain.
 9. Protective Coating: Manufacturer's standard clear coating.
 10. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] .
 - d. Overcoat: [Manufacturer's standard baked-on clear coating] [Clear organic coating] .
 11. Background Texture: [Smooth] [Pebble] [Leatherette] [Matte] [Stipple] [Match Architect's sample] [As selected by Architect from manufacturer's full range] .
 12. Integrally Cast Border Style: [As indicated on Drawings] [Square cut without border] [Square single line, polished] [Square double line, polished] [Plain bevel, brushed] [Plain bevel, polished] [Projected bevel] [Raised flat band] [Double-raised line border] .
 13. Applied Frame Material, Style, and Finish: [As indicated on Drawings] < insert description>.
 14. Mounting: [As indicated on Drawings] [Concealed studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Adhesive] [Two-face tape] .
 15. Text and Typeface: [Accessible raised characters and Braille] [Times Roman] [Typeface as indicated by manufacturer's designation] [Typeface matching Architect's sample] [Typeface as selected by Architect from manufacturer's full range] [and] [variable content as scheduled] . [Finish raised characters to contrast with background color, and finish Braille to match background color.]
- B. Etched Plaque: Chemically etched or photochemically engraved metal sheet or plate with texture, border, and characters having uniform faces, sharp corners, and precisely formed lines

and profiles; and as follows:

1. Plaque Material: Cast [aluminum] [brass] [bronze] [zinc] .
2. Plaque Thickness: As indicated on Drawings.
3. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] .
 - d. Overcoat: [Manufacturer's standard baked-on clear coating] [Clear organic coating] .
4. Integral Edge Style: [As indicated on Drawings] [Square cut, polished] [Plain bevel, brushed] .
5. Applied Frame Material, Style, and Finish: [As indicated on Drawings] < insert description>.
6. Mounting: [As indicated on Drawings] [Concealed studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] [Adhesive] [Two-face tape] .
7. Text and Typeface: [Accessible raised characters and Braille] [Times Roman] [Typeface as indicated by manufacturer's designation] [Typeface matching Architect's sample] [Typeface as selected by Architect from manufacturer's full range] [and] [variable content as scheduled] . [Finish raised characters to contrast with background color, and finish Braille to match background color.]

2.7 PLAQUE MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Brass Castings: ASTM B 584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C85200 (high-copper yellow brass)] .
- E. Brass Sheet (Yellow Brass): ASTM B 36/B 36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C26000 (yellow brass)] .
- F. Bronze Castings: ASTM B 584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C86500 (No. 1 manganese bronze)] .
- G. Bronze Plate: ASTM B 36/B 36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C22000 (commercial bronze)] .
- H. Copper Sheet: ASTM B 152/B 152M.

- I. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, [Type 304,] [Type 316,] stretcher-leveled standard of flatness.
- J. Zinc Castings: ASTM B 240, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
- K. Zinc Sheet: [ASTM B 69] < Insert standard>, alloy and temper recommended by sign manufacturer for type of use and finish indicated.

2.8 PANEL SIGNS

- A. Panel Sign as indicated on Drawings: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles.
- B. Solid-Sheet Sign[and Returns] [, Returns, and Back] : [Aluminum] [Brass] [Bronze] [Copper] [Steel] [Stainless-steel] [Acrylic] [Fiberglass] [PVC] sheet with finish specified in "Surface Finish and Applied Graphics" Subparagraph and as follows:
 - 1. Thickness: Manufacturer's standard for size of sign.
 - 2. Surface-Applied, Flat Graphics: Applied vinyl film.
 - 3. Surface-Applied, Raised Graphics: Applied polymer characters and Braille.
- C. Sign-Panel Perimeter: Finish edges smooth.
 - 1. Edge Condition: As indicated on Drawings.
 - 2. Corner Condition in Elevation: As indicated on Drawings.
- D. Mounting: Manufacturer's standard method for substrates indicated, surface mounted to wall with concealed anchors, adhesive, or two face tape.
- E. Surface Finish and Applied Graphics:
 - 1. Integral Acrylic
 - 2. Sheet Color: As selected by Architect from full range of industry colors.
- F. Text and Typeface: [Accessible raised characters and Braille] [Times Roman] [typeface as indicated by manufacturer's designation] [typeface matching Architect's sample] [typeface as selected by Architect from manufacturer's full range] [and] [variable content as scheduled] . [Finish raised characters to contrast with background color, and finish Braille to match background color.]
- G. Flatness Tolerance: Sign shall remain flat or uniformly curved under installed conditions as indicated on Drawings and within a tolerance of plus or minus [1/16 inch] < insert dimension> measured diagonally from corner to corner.

2.9 PANEL SIGN MATERIALS

- A. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- B. Vinyl Film: UV-resistant vinyl film of nominal thickness indicated, with pressure-sensitive, permanent adhesive on back; die cut to form characters or images as indicated on Drawings and suitable for exterior applications.
- C. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.

2.10 DIMENSIONAL CHARACTERS

- A. Cast Characters as indicated on Drawings: Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:
 - 1. Character Material: Cast Aluminum.
 - 2. Character Height: As indicated on Drawings.
 - 3. Thickness: As indicated on Drawings.
 - 4. Finishes:

- a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
- 5. Mounting: [As indicated on Drawings] [Concealed studs] [Projecting studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] .
- 6. Typeface: [Times Roman] < Insert requirement>.
- B. Cutout Characters as indicated on Drawings: Characters with uniform faces; square-cut, smooth and eased edges; precisely formed lines and profiles; and as follows:
 - 1. Character Material: Sheet or Plate Aluminum.
 - 2. Character Height: As indicated on Drawings.
 - 3. Thickness: As indicated on Drawings.
 - 4. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Integral Stainless-Steel Finish: [No. 4] [No. 8] [Match Architect's sample] [As selected by Architect from full range of industry finishes] .
 - d. Integral Acrylic Color: [As indicated by manufacturer's designation] [Match Architect's sample] [As selected by Architect from full range of industry colors] .
 - e. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] .
 - f. Overcoat: [Manufacturer's standard baked-on clear coating] [Clear organic coating] .
 - g. Painted Edges: Paint edges of acrylic characters with laminated metal facing as recommended in writing by manufacturer.
 - 5. Mounting: [As indicated on Drawings] [Concealed studs] [Projecting studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] .
 - 6. Typeface: [Times Roman] < Insert requirement>.
- C. Fabricated Channel Characters : [Metal face and side returns] [Open face with metal side returns] [Translucent face with metal side returns], formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners; and as follows:
 - 1. Illuminated Characters: [Backlighted] [Frontlighted] character construction with [fluorescent tube] [fiber-optic] [LED] [neon tube] lighting, including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.
 - a. Power: [As indicated on electrical Drawings] [120 V, 60 Hz, 1 phase, 15 A] .
 - b. Weeps: Provide weep holes to drain water at lowest part of exterior characters.[Equip weeps with permanent baffles to block light leakage without inhibiting

drainage.]

2. Translucent Face Sheet: Acrylic sheet with integral color [matching Architect's sample] [as selected by Architect from manufacturer's full range] .
 - a. Sheet Thickness: [As indicated on Drawings] [Manufacturer's standard thickness for size of character] [0.125 inch] [0.25 inch] .
3. Character Material: Sheet or Plate Aluminum.
4. Character Height and Depth: As indicated on Drawings.
5. Thickness: As indicated on Drawings.
6. Finishes:
 - a. Integral Metal Finish: As selected by Architect from full range of industry finishes.
 - b. Integral Aluminum Finish: Anodized color as selected by Architect from full range of industry colors and color densities.
 - c. Integral Stainless-Steel Finish: [No. 4] [No. 8] [Match Architect's sample] [As selected by Architect from full range of industry finishes] .
 - d. Baked-Enamel or Powder-Coat Finish: Manufacturer's standard, in color [as indicated by manufacturer's designation] [matching Architect's sample] [as selected by Architect from manufacturer's full range] .
 - e. Overcoat: [Manufacturer's standard baked-on clear coating] [Clear organic coating] .
7. Mounting: [As indicated on Drawings] [Concealed studs] [Projecting studs] [Rosette-head through fasteners] [Countersunk flathead through fasteners] .
 - a. Hold characters at [2-inch distance] [manufacturer's recommended distance] [distance as selected by Architect] from wall surface.
8. Typeface: [Times Roman] <Insert requirement>.

2.11 DIMENSIONAL CHARACTER MATERIALS

- A. Aluminum Castings: ASTM B 26/B 26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.
- B. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- C. Aluminum Extrusions: ASTM B 221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.
- D. Brass Castings: ASTM B 584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C85200 (high-copper yellow brass)] .
- E. Brass Sheet (Yellow Brass): ASTM B 36/B 36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C26000 (yellow brass)] .
- F. Bronze Castings: ASTM B 584, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C86500 (No. 1 manganese bronze)] .
- G. Bronze Plate: ASTM B 36/B 36M, [alloy recommended by manufacturer and finisher for finish indicated] [lead-free alloy recommended by manufacturer and finisher for finish indicated] [Alloy UNS No. C22000 (commercial bronze)] .
- H. Copper Sheet: ASTM B 152/B 152M.

- I. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, [Type 304,] [Type 316,] stretcher-leveled standard of flatness.
- J. Zinc Castings: ASTM B 240, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
- K. Zinc Sheet: [ASTM B 69] < Insert standard>, alloy and temper recommended by sign manufacturer for type of use and finish indicated.
- L. Acrylic Sheet: ASTM D 4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).
- M. Paints and Coatings for Sheet Materials: Inks, dyes, and paints that are recommended by manufacturer for optimum adherence to surface and are UV and water resistant for colors and exposure indicated.
- N. Metal Letters:

2.12 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 1. Preassemble signs in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 4. Internally brace signs for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
 5. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
 6. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
 7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.
- B. Brackets: Fabricate brackets, fittings, and hardware for bracket-mounted signs to suit sign construction and mounting conditions indicated. Modify manufacturer's standard brackets as required.
 1. Aluminum Brackets: Factory finish brackets with baked-enamel or powder-coat finish [to match sign-background color] [to match Architect's sample] color unless otherwise indicated
 2. Stainless-Steel Brackets: Factory finish brackets [to match sign background] [to match Architect's sample] [with No. 4] finish unless otherwise indicated.
- C. Surface-Engraved Graphics: Machine engrave characters and other graphic devices into indicated sign surface to produce precisely formed copy, incised to uniform depth.
 1. Engraved Opaque Acrylic Sheet: Fill engraved graphics with manufacturer's standard enamel.
 2. Face-Engraved Clear Acrylic Sheet: Fill engraved copy with manufacturer's standard enamel. Apply manufacturer's standard opaque background color coating to back face of

acrylic sheet.

- D. Subsurface-Applied Graphics: Apply graphics to back face of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.
- E. Shop- and Subsurface-Applied Vinyl: Align vinyl film in final position and apply to surface. Firmly press film from the middle outward to obtain good bond without blisters or fishmouths.

2.13 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.
- D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.14 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, [Class I, 0.018 mm] [Class II, 0.010 mm] or thicker.

2.15 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
 - 2. Directional Satin Finish: No. 4.

2.16 CLEAR ORGANIC COATING FOR COPPER-ALLOY FINISHES

- A. Clear Organic Coating: Clear, waterborne, air-drying, acrylic lacquer called "Incralac"; specially developed for coating copper-alloy products; consisting of a solution of methyl methacrylate copolymer with benzotriazole to prevent breakdown of the film in UV light; shop applied in two uniform coats according to manufacturer's written instructions, with interim drying between coats and without runs or other surface imperfections, to a total dry film thickness of 1 mil.

2.17 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following unless otherwise indicated:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. Inserts: Furnish inserts to be set by other installers into concrete or masonry work.
- B. Adhesive: As recommended by sign manufacturer.
- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- E. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of plaques, noncorrosive and compatible with each material joined, and complying with the following:
 - 1. Use concealed fasteners and anchors unless indicated to be exposed.
 - 2. For exterior exposure, furnish [nonferrous-metal] [stainless-steel] [or] [hot-dip galvanized] devices unless otherwise indicated
- F. Exposed Metal-Fastener Components, General:
 - 1. Fabricated from same basic metal and finish of fastened metal unless otherwise indicated.
 - 2. Fastener Heads: For nonstructural connections, use [flathead] [or] [oval countersunk] screws and bolts with tamper-resistant [Allen-head] [spanner-

head] [or] [one-way-head] slots unless otherwise indicated

- G. Sign Mounting Fasteners:
1. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 2. Projecting Studs: Threaded studs with sleeve spacer, welded or brazed to back of sign material, screwed into back of sign assembly, or screwed into tapped lugs cast integrally into back of cast sign material, unless otherwise indicated.
 3. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, installed in predrilled holes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Verify that electrical service is correctly sized and located to accommodate signs.

3.2 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
 4. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- B. Plaques Used for Room Identification [and Other Accessible Plaques]: Install in locations on walls [as indicated on Drawings] [and] [according to accessibility standard] .
- C. Mounting Methods:
 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 2. Projecting Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place spacers on studs, place sign in position, and push until spacers are pinched between sign and substrate, embedding the stud ends in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place spacers on studs, place sign in position with spacers pinched between sign and substrate, and install washers and nuts on stud ends projecting through opposite side of surface, and tighten.

3. Through Fasteners: Drill holes in substrate using predrilled holes in plaque as template. Countersink holes in plaque if required. Place plaque in position and flush to surface. Install through fasteners and tighten.
 4. Back Bar and Brackets: Remove loose debris from substrate surface and install backbar or bracket supports in position, so that signage is correctly located and aligned.
 5. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of signage and of suitable quantity to support weight of signage after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as signage is applied and to prevent visibility of cured adhesive at signage edges. Place signage in position, and push to engage adhesive. Temporarily support signage in position until adhesive fully sets.
 6. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.
 7. Shim-Plate Mounting: Provide 1/8-inch- thick, concealed aluminum shim plates with predrilled and countersunk holes, at locations indicated, and where other direct mounting methods are impractical. Attach plate with fasteners and anchors suitable for secure attachment to substrate. Attach signs to plate using [method specified above] .
- D. Signs Mounted on Glass: Provide opaque sheet matching sign material and finish onto opposite side of glass to conceal back of sign.
 - E. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
 - F. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

3.3 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and plaques that do not comply with specified requirements. Replace signage with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. Upon completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION

SECTION 102113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Solid plastic toilet compartments.
- B. Urinal screens.

1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Blocking and supports.
- B. Section 102800 - Toilet, Bath, and Laundry Accessories.

1.3 REFERENCE STANDARDS

- A. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on panel construction, hardware, and accessories.
- C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.
- D. Samples: Submit two samples of partition panels, 6 by 6 inch in size illustrating panel finish, color, and sheen.
- E. Closeout Submittals: Maintenance data.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Solid Plastic Toilet Compartments: Basis of Design Product: Subject to compliance with requirements, provide Scranton Products, Eclipse Partitions, or comparable product by one of the following:
 - 1. All American Metal Corp - AAMCO; _____: www.allamericanmetal.com/#sle.
 - 2. Inpro: www.inprocorp.com/#sle.
 - 3. Global Partitions globalpartitions.com

2.2 PLASTIC TOILET COMPARTMENTS

- A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted headrail-braced.
 - 1. Color: As indicated on drawings..
- B. Doors:
 - 1. Thickness: 1 inch.
 - 2. Width: 24 inch.
 - 3. Width for Handicapped Use: 36 inch, out-swinging.
 - 4. Height: 72 inch.
- C. Panels:
 - 1. Thickness: 1 inch.
 - 2. Height: 72 inch.
 - 3. Depth: As indicated on drawings.
- D. Pilasters:
 - 1. Thickness: 1 inch.
 - 2. Width: As required to fit space; minimum 3 inch.
- E. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.3 ACCESSORIES

- A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.

1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- B. Head Rails: Extruded aluminum, anti-grip profile.
- C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.
- D. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.
- E. Hinges: Stainless steel, manufacturer's standard finish.
 1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
- F. Door Hardware: Stainless steel, manufacturer's standard finish.
 1. Door Latch: Thumbturn type with exterior emergency access feature.
 2. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.2 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.
- B. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- E. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.

3.3 TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.4 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

3.5 SCHEDULES

END OF SECTION

SECTION 102600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Corner guards.

1.2 REFERENCE STANDARDS

- A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics 2023, with Editorial Revision.
- B. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies 2023.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- D. Maintenance Data: For each type of product . Include information regarding recommended and potentially detrimental cleaning materials and methods.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.
- B. Protect work from moisture damage.
- C. Protect work from UV light damage.
- D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in conformance with manufacturer's recommendations for each type of item.
- E. Store products in either horizontal or vertical position, in conformance with manufacturer's instructions.

1.5 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Corner Guards:
 - 1. Babcock-Davis; <>: www.babcockdavis.com/#sle.
 - 2. Inpro; <>: www.inprocorp.com/#sle.
 - 3. Koroseal Interior Products; <>: www.koroseal.com/#sle.
 - 4. Nystrom, Inc; <>: www.nystrom.com/#sle.
 - 5. Trim-Tex, Inc; <>: www.trim-tex.com/#sle.

2.2 PERFORMANCE CRITERIA

- A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for conformance to applicable provisions of ASTM D256 and/or ASTM F476.

2.3 PRODUCT TYPES

- A. Corner Guards - Surface Mounted:
 - 1. Material: Type 304 stainless steel, No. 4 finish, 16 gage thick.
 - 2. Width of Wings: 1 1/2" or 2" inches.
 - 3. Corner: Square.
 - 4. Color: As selected from manufacturer's standard colors.
 - 5. Length: One piece.
- B. Adhesives and Primers: As recommended by manufacturer.
- C. Mounting Brackets and Attachment Hardware: Appropriate to component and substrate.

2.4 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Pre-drill holes for attachment.
- C. Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.
- B. Verify that substrate surfaces for adhered items are clean and smooth.

3.2 INSTALLATION

- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.
- B. Position corner guard 4 inches above finished floor to ceiling.

END OF SECTION

SECTION 102800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Commercial toilet accessories.
- B. Diaper changing stations.
- C. Utility room accessories.

1.2 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2022.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.
- D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar 2023.
- E. ASTM B86 - Standard Specification for Zinc and Zinc-Aluminum (ZA) Alloy Foundry and Die Castings 2022.
- F. ASTM C1036 - Standard Specification for Flat Glass 2021.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror 2018.
- H. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use 2022.
- I. ICC A117.1 - Accessible and Usable Buildings and Facilities 2017.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data

PART 2 PRODUCTS

2.1 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
 - 1. Grind welded joints smooth.
 - 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide two (2) keys for each accessory to Architect; master key lockable accessories.
- C. Stainless Steel Sheet: ASTM A666, Type 304.
- D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.
- E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.
- F. Zinc Alloy: Die cast, ASTM B86.
- G. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- H. Adhesive: Two component epoxy type, waterproof.
- I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.
- J. Expansion Shields: Fiber, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.2 FINISHES

- A. Stainless Steel: Satin finish, unless otherwise noted.

2.3 Commercial Toilet Accessories

- A. Mirrors: Stainless steel channel framed, 1/4 inch thick annealed float glass; ASTM C1036.
 - 1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
 - 2. Size: As indicated on drawings.
 - 3. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
 - 4. Basis-of-Design: Subject to compliance with requirements, provide Bobrick B-165 2430 or comparable product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation
 - d. Gamco
- B. Grab Bars: Satin stainless steel, nonslip grasping surface finish.
 - 1. Standard Duty Grab Bars:
 - 2. Push/Pull Point Load: 250 pound-force, minimum.
 - 3. Dimensions: 1 1/2" inch outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
 - 4. Finish: Satin.
 - 5. Length and Configuration: 18", 36", and 42" as indicated on drawings and located complying with ADA requirements.
 - 6. Basis-of-Design: Subject to compliance with requirements, provide Bobrick Model 6806 Series grab bars or product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation
 - d. Gamco USA

2.4 Diaper Changing Stations

- A. Diaper Changing Station: Wall-mounted folding diaper changing station for use in commercial toilet facilities, meeting or exceeding ASTM F2285.
- B. Diaper Changing Station: Polypropylene wall-mounted folding diaper changing station for use in commercial facilities.
 - 1. Material: Polypropylene.
 - 2. Mounting: Surface.
 - 3. Color: Gray.
 - 4. Basis-of-Design: Subject to compliance with requirements, provide Bobrick KC200 baby changing station or comparable product by one of the following:
 - a. AJW Architectural Products
 - b. American Specialties, Inc.
 - c. Bradley Corporation
 - d. Gamco USA

2.5 Utility Room Accessories

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
 - 1. Drying rod: Stainless steel, 1/4 inch diameter.
 - 2. Hooks: 2, 0.06 inch stainless steel rag hooks at shelf front.
 - 3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
 - 4. Length: Manufacturer's standard length for number of holders/hooks.

5. Basis-of-Design: Subject to compliance with requirements, provide American Specialties, Inc. 1315-3 utility shelf/mop and broom holder or comparable product by one of the following:
 - a. AJW Architectural Products
 - b. Bradley Corporation
 - c. Gamco USA

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.
- D. Verify that field measurements are as indicated on drawings.

3.2 PREPARATION

- A. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights: As required by accessibility regulations and as indicated on drawings.

3.4 PROTECTION

- A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 104400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.

1.2 REFERENCE STANDARDS

- A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).
- B. NFPA 10 - Standard for Portable Fire Extinguishers 2022.
- C. UL (DIR) - Online Certifications Directory Current Edition.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions for each type of product.
- C. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4 FIELD CONDITIONS

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fire Extinguishers:
 - 1. Ansul, a Tyco Business: www.ansul.com.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 3. Nystrom, Inc: www.nystrom.com/sle.
 - 4. Amerex..
 - 5. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - 6. Larsens Manufacturing Company.
 - 7. Guardian Fire Equipment, Inc.
- B. Fire Extinguisher Cabinets and Accessories:
 - 1. Activar Construction Products Group: www.activarcpg.com/#sle.
 - 2. Kidde, a unit of United Technologies Corp: www.kidde.com.
 - 3. Larsen's Manufacturing Co: www.larsensmfg.com.
 - 4. Nystrom, Inc: www.nystrom.com/sle.
 - 5. Guardian Fire Equipment, Inc..

2.2 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
 - 1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.
- B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gage.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; MP10 or comparable product by one of the manufacturers listed above.
 - 2. Class: A:B:C type.
 - 3. Size: 10 pound.
 - 4. Finish: Baked polyester powder coat, red color.
 - 5. Temperature range: Minus 65 degrees F to ___ degrees F.
- C. Wet Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; WC-6L or comparable product by one of the manufacturers

listed above.

2. Class: K type.
3. Size: 1.6 gallons.
4. Finish: Polished stainless steel.
5. Temperature range: 40 degrees F to 120 degrees F.

2.3 FIRE EXTINGUISHER CABINETS

- A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.
- B. Cabinet Construction: Non-fire rated.
- C. Fire Rated Cabinet Construction: One-hour fire rated.
- D. Cabinet Configuration: Recessed type with multipurpose dry chemical fire extinguisher.
 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R2 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 2. Size to accommodate accessories.
 3. Trim: Flat edge.
 4. Trim and Door Material: Steel sheet.
 5. Door Glazing: Clear transparent acrylic sheet.
 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.
 - c. Lettering color: Red.
 - d. Orientation: Vertical.
- E. Cabinet Configuration: Semi-recessed type with multipurpose dry chemical fire extinguisher.
 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-R7 Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 2. Size to accommodate accessories.
 3. Trim: Square edge.
 4. Trim and Door Material: Steel sheet.
 5. Door Glazing: Clear transparent acrylic sheet.
 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.
 - c. Lettering color: Red.
 - d. Orientation: Vertical.
- F. Cabinet Configuration: Surface mounted type with multipurpose dry chemical fire extinguisher.
 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2409-SM Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 2. Size to accommodate accessories.
 3. Trim: Not applicable.
 4. Trim and Door Material: Steel sheet.
 5. Door Glazing: Clear transparent acrylic sheet.
 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.

- c. Lettering color: Red.
 - d. Orientation: Vertical.
- G. Cabinet Configuration: Recessed type with wet chemical fire extinguisher.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2712-R Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 - 2. Size to accommodate accessories.
 - 3. Trim: Flat edge.
 - 4. Trim and Door Material: Steel sheet.
 - 5. Door Glazing: Clear transparent acrylic sheet.
 - 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.
 - c. Lettering color: Red.
 - d. Orientation: Vertical.
- H. Cabinet Configuration: Semi-recessed type with wet chemical fire extinguisher.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2712-RK Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 - 2. Size to accommodate accessories.
 - 3. Trim: Square edge.
 - 4. Trim and Door Material: Steel sheet.
 - 5. Door Glazing: Clear transparent acrylic sheet.
 - 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.
 - c. Lettering color: Red.
 - d. Orientation: Vertical.
- I. Cabinet Configuration: Surface mounted type with wet chemical fire extinguisher.
 - 1. Basis of Design Product: Subject to compliance with requirements, provide Larsens Manufacturing Company; 2712-SM Architectural Series Vertical Duo or comparable product by one of the manufacturers listed above.
 - 2. Size to accommodate accessories.
 - 3. Trim: Not applicable.
 - 4. Trim and Door Material: Steel sheet.
 - 5. Door Glazing: Clear transparent acrylic sheet.
 - 6. Identification: Identify fire extinguisher in fire protection cabinet with the words FIRE EXTINGUISHER. Comply with requirements of authorities having jurisdiction.
 - a. Location: Applied to cabinet door.
 - b. Application process: Pressure-sensitive vinyl letters.
 - c. Lettering color: Red.
 - d. Orientation: Vertical.
- J. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 60 inches from finished floor to top of cabinet, confirm height acceptable to authorities having jurisdiction.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.

END OF SECTION

SECTION 107500 - FLAGPOLES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Aluminum Flagpoles.

1.2 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete base and foundation construction.

1.3 REFERENCE STANDARDS

- A. AASHTO M 36 - Standard Specification for Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains 2016 (Reapproved 2020).
- B. ASTM B241/B241M - Standard Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube 2022.
- C. NAAMM FP 1001 - Guide Specifications for Design Loads of Metal Flagpoles 2007.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on pole, accessories, and configurations.
- C. Shop Drawings: Indicate detailed dimensions, base details, anchor requirements, and imposed loads.
- D. Delegated-Design Submittal: For flagpoles.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Spiral wrap flagpole with protective covering and pack in protective shipping tubes or containers.
- B. Protect flagpole and accessories from damage or moisture.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For flagpoles to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Flagpoles:
 - 1. Source Limitations: Obtain flagpoles as complete units, including fittings, accessories, bases, and anchorage devices, from single source from single manufacturer.
 - 2. American Flagpole; <>: www.americanflagpole.com/#sle.
 - 3. Concord Industries, Inc; <>: www.concordindustries.com/#sle.
 - 4. Pole-Tech Co, Inc; <>: www.poletech.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.

2.2 FLAGPOLES

- A. Flagpoles: Designed in accordance with NAAMM FP 1001
 - 1. Material: Aluminum.
 - 2. Design: Straight shaft.
 - 3. Mounting: Ground mounted type.
 - 4. Nominal Height: 25 ft; measured from nominal ground elevation.
 - 5. Halyard: Interior type .
- B. Performance Requirements:
 - 1. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design flagpole assemblies.
 - 2. Structural Performance: Flagpole assemblies, including anchorages and supports, shall withstand design loads indicated within limits and under conditions indicated.
 - 3. Wind Pressure Loading on Flagpole with Flag: Resistant without permanent deformation to 120 miles/hr wind speed, in accordance with NAAMM FP 1001; the factor of safety used is 2.5.

2.3 POLE MATERIALS

- A. Aluminum: ASTM B241/B241M , 6063 alloy , T6 temper.

2.4 ACCESSORIES

- A. Finial Ball: Stainless steel, 6 inch diameter.
- B. Cleats: 9 inch size, aluminum with galvanized steel fastenings, two per halyard.
- C. Halyard: 5/16 inch diameter polypropylene, braided, white.
- D. Halyard Flag Snaps: Nylon swivel snap hooks with neoprene or vinyl covers. Furnish two per halyard.
- E. Finish exposed metal surfaces to match flagpole.

2.5 MOUNTING COMPONENTS

- A. Foundation Tube Sleeve: AASHTO M 36, corrugated 16 gage, 0.0598 inch steel, galvanized, depth of ____ inches as indicated.

2.6 MISCELLANEOUS MATERIALS

- A. Drainage Material: Crushed stone, or crushed or uncrushed gravel; coarse aggregate.
- B. Sand: ASTM C 33/C 33M, fine aggregate.
- C. Elastomeric Joint Sealant: Multicomponent nonsag urethane joint sealant complying with requirements in Section 07 92 00 "Joint Sealants."
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.

2.7 FINISHING

- A. Aluminum: Mill finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that concrete foundation is ready to receive work and dimensions are as indicated on shop drawings.

3.2 PREPARATION

- A. Prepare uncoated metal flagpoles that are set in foundation tubes by painting below-grade portions with a heavy coat of bituminous paint.
- B. Foundation Excavation: Excavate to neat clean lines in undisturbed soil. Remove loose soil and foreign matter from excavation and moisten earth before placing concrete. Place and compact drainage material at excavation bottom.
- C. Foundation Tube: Place foundation tube, center, and brace to prevent displacement during concreting. Place concrete. Plumb and level foundation tube and allow concrete to cure.
- D. Sleeves: Locate and secure sleeves in forms by bracing to reinforcement and forms.
- E. Place concrete, as specified in Section 03 30 00 "Cast-in-Place Concrete." Compact concrete in place by using vibrators. Moist-cure exposed concrete for no fewer than seven days or use nonstaining curing compound.
- F. Trowel exposed concrete surfaces to a smooth, dense finish, free of trowel marks, and uniform in texture and appearance. Provide positive slope for water runoff to perimeter of concrete base.

3.3 INSTALLATION

- A. Install flagpole , base assembly, and fittings in accordance with manufacturer's instructions.
- B. Foundation Tube: Place flagpole in tube, seated on bottom plate between steel centering wedges, and install hardwood wedges to secure flagpole in place. Place and compact sand in foundation tube and remove hardwood wedges. Seal top of foundation tube with a 2-inch layer of elastomeric joint sealant and cover with flashing collar.

3.4 TOLERANCES

- A. Maximum Variation From Plumb: 1 inch.

3.5 ADJUSTING

- A. Adjust operating devices so that halyard and flag function smoothly.

END OF SECTION

SECTION 111313 - LOADING DOCK BUMPERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Loading dock bumpers of reinforced rubber pads with attachment frame.

1.2 RELATED REQUIREMENTS

- A. Section 031000 - Concrete Forming and Accessories: Placement of loading dock bumper frame anchors into concrete.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on unit dimensions, method of anchorage, and details of construction.
- C. Manufacturer's Installation Instructions: Submit installation requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Dock Bumpers
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Blue Giant Equipment Corporation; _____: www.bluegiant.com/#sle.
 - b. American Floor Products Company, Inc.
 - c. Beacon Industries, Inc.
 - d. Chalfant Sewing Fabricators, Inc: www.chalfantusa.com/#sle.
 - e. Durable Corp: www.durablecorp.com/#sle.
 - f. Hugger Dock Equipment Company; Columbus Foam Products, Inc.
 - g. Kelley; 4Front Engineered Solutions, Inc.
 - h. Pioneer Dock Equipment.
 - i. Rite-Hite Corporation.
 - j. Rotary Products, Inc.
 - k. Serco; 4Front Engineered Solutions, Inc.
 - l. Super Seal Mfg. Ltd.
 - m. Vestil Manufacturing Company.

2.2 COMPONENTS

- A. Loading Dock Bumpers: Fabric reinforced rubber pads, ozone resistant, laminated and compressed in position using two galvanized steel rods with threaded ends, washers, and nuts between 3 inch high by 2-1/2 inch wide by 1/4 inch thick galvanized steel angle end plates.
 - 1. Projection From Wall: 4-1/2 inches.
 - 2. Vertical Height: 20 inches.
 - 3. Width: 8 inches.
- B. Attachment Hardware: 3/4 inches diameter galvanized bolts with expansion shields.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that anchor placement is acceptable.

3.2 INSTALLATION

- A. Install dock bumpers in accordance with manufacturer's instructions.
- B. Set plumb and level.
- C. Secure angled end frames to concrete; refer to Section 031000 for additional information.

END OF SECTION

SECTION 122400 - WINDOW SHADES

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Interior manual roller shades.

1.2 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.3 REFERENCE STANDARDS

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Sequencing:
 - 1. Do not fabricate shades until field dimensions for each opening have been taken with field conditions in place.
 - 2. Do not install shades until final surface finishes and painting are complete.

1.5 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets, including materials, finishes, fabrication details, dimensions, profiles, mounting requirements, and accessories.
 - 1. Motorized Shades: Include power requirements and standard wiring diagrams for specified products.
- C. Shop Drawings: Include shade schedule indicating size, location and keys to details, head, jamb and sill details, mounting dimension requirements for each product and condition, and operation direction.
- D. Selection Samples: Include fabric samples in full range of available colors and patterns.
- E. Verification Samples: Minimum size 6 inches square, representing actual materials, color and pattern.
- F. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of shop drawings.
- G. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of this type with minimum three years of documented experience with shading systems of similar size and type.
 - 1. Manufacturer's authorized representative.
 - 2. Factory training and demonstrated experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver shades in manufacturer's unopened packaging, labeled to identify each shade for each opening.
- B. Handle and store shades in accordance with manufacturer's recommendations.

1.8 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.9 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide manufacturer's warranty from Date of Substantial Completion, covering the following:
 - 1. Shade Hardware: One year.
 - 2. Fabric: One year.
 - 3. Aluminum and Steel Coatings: One year.

PART 2 PRODUCTS

2.1 Manufacturers

- A. Interior Manually Operated Roller Shades:
 - 1. **Crown Shade; Chain.** www.crownshade.com
 - 2. Draper, Inc; Clutch Operated FlexShade: www.draperinc.com/#sle.
 - 3. Hunter Douglas Architectural; RB500 Manual Roller Shades:
www.hunterdouglasarchitectural.com/#sle.
 - 4. Lutron Electronics Co., Inc; Contract Roller Manual Roller Shades: www.lutron.com/#sle.
 - 5. MechoShade Systems LLC; Mecho/7 System: www.mechoshade.com/#sle.
 - 6. SWFcontract, a division of Springs Window Fashions, LLC.; <>:
www.swfcontract.com/#sle.
 - 7. PowerShades..

2.2 Roller Shades

- A. General:
 - 1. Provide shade system components that are easy to remove or adjust without removal of mounted shade brackets.
 - 2. Provide shade system that operates smoothly when shades are raised or lowered.
- B. Interior Roller Shades - Basis of Design: Draper, Inc; Clutch Operated FlexShade:
www.draperinc.com/#sle.
 - 1. Description: Single roller, manually operated fabric window shade system complete with mounting brackets, roller tubes, hembars, hardware, and other components necessary for complete installation.
 - a. Mounting: Wall mounted.
 - 2. Mounting Hardware: As recommended by manufacturer for mounting indicated and to accommodate shade fabric roll-up size and weight.
 - 3. Roller Tubes: As required for type of shade operation; designed for removal without removing mounting hardware.
 - a. Material: Extruded aluminum or steel, with wall thickness and material selected by manufacturer.
 - b. Size: As recommended by manufacturer; selected for suitability for installation conditions, span, and weight of shades.
 - 4. Hembars: Designed to maintain bottom of shade straight and flat, selected from manufacturer's standard options.
 - 5. Manual Operation:
 - a. Clutch Operator: Manufacturer's standard material and design, permanently lubricated.
 - b. Drive Chain: Continuous loop stainless steel beaded ball chain, 95 lb minimum breaking strength. Provide upper and lower limit stops.

2.3 Roller Shade FABRICATION

- A. Field measure finished openings prior to ordering or fabrication.
- B. Dimensional Tolerances: As recommended in writing by manufacturer.
- C. At openings requiring continuous multiple shade units with separate rollers, locate roller joints at window mullion centers; butt rollers end-to-end.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine finished openings for deficiencies that may preclude satisfactory installation.
- B. Start of installation shall be considered acceptance of substrates.

3.2 PREPARATION

- A. Prepare surfaces using methods recommended by manufacturer for achieving best result for substrate under the project conditions.
- B. Coordinate with window installation and placement of concealed blocking to support shades.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and approved shop drawings, using mounting devices as indicated.
- B. Replace shades that exceed specified dimensional tolerances at no extra cost to Owner.
- C. Adjust level, projection, and shade centering from mounting bracket. Verify there is no telescoping of shade fabric. Ensure smooth shade operation.

3.4 CLEANING

- A. Clean soiled shades and exposed components as recommended by manufacturer.
- B. Replace shades that cannot be cleaned to "like new" condition.

3.5 CLOSEOUT ACTIVITIES

- A. See Section 017800 - Closeout Submittals, for closeout submittals.
- B. See Section 017900 - Demonstration and Training, for additional requirements.
- C. Demonstration: Demonstrate operation and maintenance of window shade system to Owner's personnel.

3.6 PROTECTION

- A. Protect installed products from subsequent construction operations.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 123600 - COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Countertops for architectural cabinet work.

1.2 RELATED REQUIREMENTS

- A. Section 064100 - Architectural Wood Casework.

1.3 REFERENCE STANDARDS

- A. ANSI A208.1 - American National Standard for Particleboard 2022.
- B. ANSI A208.2 - Medium Density Fiberboard (MDF) for Interior Applications 2022.
- C. ISFA 3-01 - Classification and Standards for Quartz Surfacing Material 2013.
- D. MIA (DSDM) - Dimensional Stone Design Manual, Version VIII 2016.
- E. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- F. PS 1 - Structural Plywood 2019.

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Specimen warranty.
- C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.
- D. Verification Samples: For each finish product specified, minimum size 6 inches square, representing actual product, color, and patterns.
- E. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

- A. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
 - 1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch nominal thickness.
 - a. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1) Formica Corporation: www.formica.com.
 - 2) Lamin-Art, Inc: www.laminart.com.
 - 3) Panolam Industries International, Inc Nevamar: www.nevamar.com.
 - 4) Panolam Industries International, Inc Pionite: www.pionitelaminates.com.
 - 5) Wilsonart: www.wilsonart.com.
 - b. Laminate Core Color: Same as decorative surface.
 - c. Finish: Matte or suede, gloss rating of 5 to 20.

- d. Surface Color and Pattern: As indicated on drawings.
- 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
- 3. Back and End Splashes: Same material, same construction.
- 4. Fabricate in accordance with manufacturer's standard requirements.
- B. Natural Quartz and Resin Composite Countertops: Sheet or slab of natural quartz and plastic resin over continuous substrate.
 - 1. Flat Sheet Thickness: 3/4 inch, minimum.
 - 2. Natural Quartz and Resin Composite Sheets, Slabs and Castings: Complying with ISFA 3-01 and NEMA LD 3; orthophthalic polyester resin, mineral filler, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
 - a. Manufacturers:
 - 1) E.I. du Pont de Nemours and Company: www.dupont.com
 - 2) Daltile; ONE: www.daltilestonecenter.com
 - 3) Consentino; Silestone USA: www.silestoneusa.com
 - 4) Terrazzo & Marble Supply Companies; DIFINITI Quartz: www.tmsupply.com/#sle.
 - 5) Terrazzo & Marble Supply Companies; Diresco Belgium Quartz, a brand of Diresco - North America: www.tmsupply.com/#sle.
 - 6) Wilsonart: www.wilsonart.com.
 - b. Factory fabricate components to the greatest extent practical in sizes and shapes indicated; comply with the MIA Dimension Stone Design Manual.
 - c. Finish on Exposed Surfaces: Polished.
 - d. Color and Pattern: As indicated on drawings.
 - 3. Other Components Thickness: 3/4 inch, minimum.
 - 4. Exposed Edge Treatment: Built up to minimum 1-1/4 inch thick; square edge; use marine edge at sinks.
 - 5. Back and End Splashes: Same sheet material, square top; minimum 4 inches high.
 - 6. Fabricate in accordance with manufacturer's standard requirements.

2.2 MATERIALS

- A. Plywood for Supporting Substrate: PS 1 Exterior Grade, A-C veneer grade, minimum 5-ply; minimum 3/4 inch thick; join lengths using metal splines.
- B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 3/4 inch thick; join lengths using metal splines.
- C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.
- D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.
- E. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.3 FABRICATION

- A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
 - 1. Join lengths of tops using best method recommended by manufacturer.
 - 2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.
 - 3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.
- B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
 - 1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.

2. Height: 4 inches, unless otherwise indicated.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.
- C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.
- B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.
- C. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

- A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.
- B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.
- C. Field Joints: 1/8 inch wide, maximum.

3.5 CLEANING

- A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 126100 - FIXED AUDIENCE SEATING

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Fixed, upholstered theater chairs.
- B. Support standards.
- C. Chair accessories.

1.2 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- C. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.
- D. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface 2022.
- E. ASTM D3597 - Standard Performance Specification for Woven Upholstery Fabrics—Plain, Tufted, or Flocked 2002, with Editorial Revision (2018).
- F. ASTM E1352 - Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies 2016.
- G. ASTM E1537 - Standard Test Method for Fire Testing of Upholstered Furniture 2022.
- H. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood 2020.
- I. NEMA LD 3 - High-Pressure Decorative Laminates 2005.
- J. NFPA 261 - Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes 2023.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Coordination with Electrical Work: Coordinate installation of wiring to ensure that floor-mounted junction boxes are completely beneath seats and free of aisle spaces.

1.4 SUBMITTALS

- A. Product Data: Manufacturer's printed data sheets for products specified.
- B. Shop Drawings: Fabrication and installation details, chair layouts and dimensions and seat numbering scheme.
 - 1. Field Measurements: Verify seating layout by field measurements and record field dimensions on shop drawings.
- C. Selection Samples: Manufacturer's color charts and swatches for fabric upholstery, indicating full range of materials, colors, and patterns available.
- D. Verification Samples: Full-size two-seat fabricated sample of each type of chair specified, including all accessories and one end panel, illustrating all finishes and workmanship to be expected in the finished Work; approved sample may be incorporated into the Work.
- E. Maintenance Materials:
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Seats: Quantity equal to 5 percent of total installed, but not less than one of each type and width of seat, furnished from same production run as that installed.
 - 3. Extra Fabric: Quantity sufficient for reupholstering 5 percent of installed seating.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer certified in writing by the seating manufacturer to be qualified for installation of specified seating.
- B. Fire Retardance of Upholstered Seating: Self-extinguishing when mock-up is exposed to smoldering cigarettes in accordance with ASTM E1352 or NFPA 261.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver seats to project site in unopened containers clearly labeled with manufacturer's name and identification of contents.
- B. Store seating units in dry and clean location until needed for installation. During installation, handle in a manner that will prevent marring and soiling of finished surfaces.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Fixed Theater Seating:
 - 1. American Seating Inc.
 - 2. Hussey Seating Company.
 - 3. Irwin Seating Company.
 - 4. KI.
 - 5. Seating Concepts, LLC.
 - 6. Theatre Solutions, Inc.
 - 7. Wenger Seating.
- B. Provide all theater seating by one manufacturer.

2.2 MATERIALS

- A. Sheet Steel: ASTM A879/A879M, Commercial Steel (CS) or Drawing Steel (DS) electrogalvanized sheet, 04Z (12G) coating class on both surfaces; chemically treated for baked enamel finish.
- B. Steel Plates, Bars, and Tubes: ASTM A36/A36M.
- C. Exposed Hardwood: Solid lumber selected for absence of visible defects; birch, northern hard maple, white oak, or species standard with manufacturer.
- D. Hardwood Plywood: HPVA HP-1; face veneers for exposed surfaces Grade A birch, hard maple, walnut, or as standard with manufacturer, with no visible defects; concealed surface veneers of sound grade hardwood.
- E. Laminated Plastic: NEMA LD 3, Type 1, Grade GP 50, nominal thickness 0.050 in; colors and patterns as scheduled.
- F. Polypropylene Sheet: Molded high density plastic with minimum tensile strength of 3300 psi, integral color pigments, and textured, scuff-resistant surface finish.
- G. Polyurethane Foam: Density not less than 1.8 lb/cu ft, fire retardant, non-hardening and non-oxidizing, with high resistance to alkalis, oils, moisture, and mildew.
- H. Upholstery Fabric: Manufacturer Absecon Mills; fabric designation Icon; color and pattern Grey.
 - 1. Above fabric designation is intended to establish fabric material; weight, weave, surface texture, pattern, and color required. Products by other manufacturers that match the specified product in all essential respects may be substituted, with Architect's prior approval.

2.3 UPHOLSTERED CHAIRS

- A. Fixed seating system designed to permit radial installation using common middle support standards in each row and aisle standards aligned as indicated on drawings. Width of seats not less than 22 inches, except exit seat locations may be reduced to 20 inches to complete specific row dimensions.
- B. Backs: Fixed type; two-panel construction with fabric covering over padding and protective back panel, with installed height not less than 32 inches above finished floor.
 - 1. Structural Support: One-piece die-formed steel sheet.
 - 2. Padding: Polyurethane foam not less than 1 in thick bonded to structural support.
 - 3. Covering: Fabric bonded to padding and fastened by upholstery technique that facilitates replacement.
 - 4. Rear Panel: One-piece die-formed steel sheet.
- C. Seats: Hinged type, constructed to permit reupholstering without removing seat from chair.
 - 1. Steel Seat Construction: One-piece sheet steel pan construction, reinforced at stress points and designed to completely enclose hinges and self-rising seat mechanism; supporting not fewer than 16 coil springs or five non-sag serpentine springs. Separate padding from springs with burlap sheeting cemented to polyurethane foam padding formed with minimum thickness of 1-3/4 in. Upholster with fabric sewn into box

construction without welts and securely fastened to supporting frame to provide smooth, wrinkle-free surface.

- a. For serpentine spring construction, provide not less than 3 in thick foam padding at front edge of seat.
- D. Hinges: Self-lubricating, noiseless steel hinges with brass alloy bearings or nylon bushings, equipped with spring mechanism that causes unoccupied seat to rise automatically to uniform 3/4 fold, with 100 percent fold when additional pressure is applied.
- E. Arm Rests: Locate at aisles and between chairs; mount to support standard with concealed fasteners; exposed surfaces of molded high-impact plastic.
- F. End Panels: One piece panels fastened securely to aisle standards with concealed fasteners, configured as follows:
 1. Shape: Tapered.
 2. Finish: Plastic laminate.

2.4 STANDARDS

- A. Support Standards: Tubular steel with welded mounting points for backs, seats, and arm rests, and welded floor anchor plates.

2.5 ACCESSORIES

- A. Seat and Aisle Numbers: Manufacturer's standard seat numbers securely fastened to front edge of folding seats and row numbers securely fastened to aisle arm rests; anodized aluminum finish, with letters and numbers countersunk and filled with black paint.

2.6 FINISHES

- A. Ferrous Metals: Manufacturer's standard two-coat baked enamel finish, applied over conversion coating appropriate to base metal.
 1. Color and Gloss: As selected from manufacturer's standard choices.
- B. Hardwood: Manufacturer's standard clear low-gloss finish.
- C. Hardwood Plywood: Manufacturer's standard clear low-gloss finish.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine substrates for conditions detrimental to installation of fixed theater seating. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's installation instructions and approved shop drawings.
- B. Anchor support standards securely to substrate with at least two anchoring devices recommended by manufacturer.
 1. Place standards in each row laterally so the standards at the aisle will be in alignment.
 2. Vary width of seats and backs as required to optimize sightlines, and comply with the ADA Standards for row and aisle widths.
 3. In curved rows, install standards to form smooth radius, without breaks or angled chords

3.3 ADJUSTING

- A. Adjust seat mechanisms to ensure that seats in each row are aligned when unoccupied.
- B. Repair minor abrasions and imperfections in painted finishes with a coating that matches factory-applied finish; replace units that cannot be repaired to unblemished appearance.
- C. Replace upholstery fabric damaged or soiled during installation.

END OF SECTION

SECTION 126613 - TELESCOPING BLEACHERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Telescoping bleachers.
- B. Electric motor operators, controls, and internal wiring.

1.2 RELATED REQUIREMENTS

- A. Section 260583 - Wiring Connections: Connection of electric motors and controls.

1.3 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design 2010.
- B. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- C. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel 2018, with Errata (2022).

1.4 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage handling and requirements.
 - 3. Installation methods.
- C. Shop Drawings: Complete layout with dimensions, seat heights, row spacing and rise, aisle widths and locations, points of connection to substrate, assembly dimensions, and material types and finishes.
 - 1. Provide drawings customized to this project.
 - 2. Include Professional Engineer certification.
 - 3. Wiring Diagrams: Show locations of motors, electrical wiring, and rough-in connections.
- D. Selection Samples: For each material for which color selection is required, submit samples, 2 by 2 inches in size, illustrating colors and finishes available.
- E. Operation and Maintenance Data: Manufacturer's operation and maintenance instructions, including annual inspection and maintenance and bi-annual inspection by a Professional Engineer or manufacturer factory service personnel.
- F. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Manufacturer's installation crew.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Store, in original packaging, under cover and elevated above grade.

1.7 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion. Replace parts that fail under normal use at no extra charge to Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Telescoping Bleachers:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Hussey Seating Company, MAXAM+, or comparable product by one of the following:
 - a. Interkal LLC; _____: www.interkal.com/#sle.
 - b. Irwin Telescopic Seating Company; _____: www.irwintelescopicseating.com/#sle.

2.2 TELESCOPING BLEACHERS

- A. Telescoping Bleachers: Factory assembled tiered benches with upholstered fixed seating that retract horizontally into depth approximately the same as a single row depth, with fixed seats

mounted on leading edge of platforms.

1. Design to comply with applicable requirements of NFPA 102 and requirements of code authorities having jurisdiction; where conflicts between requirements occur, comply with whichever is more stringent.
 2. Design with solid fascia (riser) or seat fronts that conceal interior mechanisms when fully retracted, fitting tightly enough to prevent climbing up face; at front row provide key locked, hinged fascia (skirt) to cover gap between seat riser/fascia and floor.
 3. Configurations: As indicated on drawings.
 4. Wheelchair Spaces: Comply with ADA Standards as required for project.
 5. Operation: Motor operated.
- B. Design Loads: Design to withstand the following loading conditions:
1. Live Load on Structural Supports: 100 psf, minimum, of gross horizontal projection.
 2. Live Load on Seats and Walking Surfaces: 120 pounds per linear foot.
 3. Lateral Sway Stress on Structural Supports: 24 pounds per linear foot of seat plank.
 4. Perpendicular Sway Stress on Structural Supports: 10 pounds per linear foot of seat plank.
- C. Dimensions:
1. See drawings for overall dimensions.
- D. Structural Supports: Steel or aluminum; manufacturer's standard wheeled carriages supporting each tier separately, with moving parts permanently lubricated and metal parts cushioned to prevent metal-to-metal contact during operation.
1. Design so that each row carriage so that it will individually support the design loads and is self supporting when fully assembled without dependence on platform panels or boards, seats, or fascia.
 2. Welding: In accordance with AWS D1.1/D1.1M and AWS D1.3/D1.3M.
 3. Bolting: Use lock-washers or locknuts.
 4. Wheels: Minimum 5 inch diameter by 1-1/8 inch wide, with non-marring rubber tires; ball, roller, or oil-impregnated metal bearings; minimum of 2 wheels at each floor support.
 5. Finish: Manufacturer's standard enamel or powder coating.
 6. Row Locking: Automatically mechanically lock each carriage to adjacent carriages when fully extended.
 7. Unlocking: Automatically unlock all rows before engaging retraction mechanism.
- E. Motor Operation: Manufacturer's standard drive mechanism, using motor adequately sized for the purpose.
1. Provide UL listed electrical components and wiring.
 2. Controls: Start, Stop, Forward, and Reverse in a single control unit.
 3. Control Station: Wireless control system.
 4. Limit Switches: Automatically stop operation when unit has reached fully open or fully closed position.
 5. Provide all wiring internal to bleacher units, to junction box located where indicated; ensure that wiring is not energized except during operation.
 6. Electrical Characteristics: 208/230V, 5 wire, 3-phase, 60 Hz.
 7. Provide access to motor from front side of bleachers; a hinged front skirt or hinged section at least 30 inches wide is acceptable.

2.3 SEAT AND PLATFORM COMPONENTS

- A. Seat/Fascia Assembly: Continuous, molded UV-stabilized high-density polyethylene plastic, seat minimum 1 inch thick, textured finish, homogeneous color throughout, color as selected from manufacturer's standard selection; approximately 18 inch long sections independently removable with tongue-and-groove or rabbeted interlock at end joints.

1. Shape: Ergonomically contoured, with internal ribs spaced for natural flexibility; rear edge cantilevered to provide toe room of not less than 3 inches; no openings to trap debris.
 2. Provide end caps of same material and finish on each exposed end.
 3. Supports: Internal steel reinforcement of each seat segment bolted to platform nose member; minimum two bolts per segment.
- B. Platform, Tread, and Step Structure: Plywood continuously supported on front and rear with side joints tongue-and-grooved.
1. Plywood: PS 1, 5-ply southern pine or polyethylene-overlaid douglas fir or southern pine, Grade A-C.
 2. Plywood Thickness: 5/8 inch, minimum.
 3. Front (Nose), Rear, and Intermediate Supports: Steel channel or tube, hot-dipped galvanized.
 4. Provide end caps of same material and finish on each exposed end.

2.4 HANDRAILS AND RAILINGS

- A. Provide the following railings:
1. End of Row Guardrails: Self-storing, at open ends of sections beginning at row 2.
 2. Height: 42 inches above adjacent platform or tread.
- B. Design handrails and railings to withstand the following loads:
1. Concentrated Load on Guardrails: 200 pounds in any direction along top rail.
 2. Live Load on Guardrails:
 - a. Horizontal: 50 pounds per linear foot, applied at the guardrail height.
 - b. Vertical: 100 pounds per linear foot, applied vertically to top of guardrail.
- C. Railing Construction: Round steel or aluminum pipe or tube, with formed elbows at corners and caps at ends of straight runs.
1. Aluminum: 1.66 inches minimum outside diameter; natural anodized finish.

2.5 ACCESSORIES

- A. Fillers and Closures:
1. Top Row: Provide seat level rear filler panels to close openings between top row seat and wall; finish to match platforms.
- B. Control Devices: Wireless, hand-held, wireless transmission unit that operates wireless receivers in each operating section, with a transmission range to keep handheld control unit within close proximity and with full view of stand its movement area. project one unit for each operating section.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that field measurements are consistent with those on the shop drawings.
- B. Verify that electrical rough-ins have been installed and are accessible.
- C. Do not begin installation until substrates have been properly prepared and area has been cleared of obstructions.
- D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Do not field cut or alter seats, fascia, or structural members without approval.
- C. Provide manufacturer's field representative to inspect completed installation.

3.4 ADJUSTING

- A. Lubricate, test, and adjust each moving assembly to ensure proper operation in compliance with manufacturer's recommendations.

3.5 CLEANING

- A. Clean exposed and semi-exposed assembly surfaces.
- B. Touch up finishes on damaged or soiled areas.

3.6 CLOSEOUT ACTIVITIES

- A. Demonstration and Training: Provide manufacturer's field representative to demonstrate to and train Owner's operating personnel in proper operation of equipment.
 - 1. Location: On site using installed equipment.
 - 2. Time: As agreed between Owner and Contractor.

3.7 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 133419 - METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame.
- B. Insulated Metal wall and roof panels including soffits.

1.2 SCOPE

- A. ***Design Criteria: The Contract includes a metal building system which may require deviations from the manufacturer's standard configurations. The drawings indicate (sizes, profiles, and dimensional requirements) of the pre-engineered metal building system. The design criteria, load limits, and other requirements may not be deviated from without written approval from the Architect. Metal buildings systems conforming to all performance characteristics without deviations, may be considered. Any deviations that may result in changes or additional costs, including all Architectural and Engineering services to review and remedy such deviations, shall be the full responsibility of the Sub-Contractor providing the building.***

1. Some of the special requirements are as follows (See Structural and Architectural Drawings):
 - a. Column locations and spacing.
 - b. Bracing location and type.
 - c. Connections for structural components by other suppliers.
 - d. Additional loading.
 - e. Maximum load limits on foundations.
 - f. Supply anchor bolts.
 - g. Additional framing and loads to support mechanical equipment.
 - h. Collateral roof loading of misc. equipment as indicated in Structural Drawings.
 - i. Girt locations as shown.
 - j. Gutter and eave details.
 - k. Building Stiffness as indicated in Structural Drawings.
 - l. Meet uplift as indicated in Structural Drawings.
2. If the manufacturer discovers any of the criteria to be in conflict with any other criteria and/or considers any criteria to be prohibitively expensive, the Sub-Contractor is obligated to inform the Architect prior to bid opening so that a formal interpretation or change by be issued in writing. Unless there is a formal modification to the Contract, all requirements shall be fulfilled at no additional cost to the Owner/Design Team.

1.3 RELATED REQUIREMENTS

- A. Section 079200 - Joint Sealants: Sealing joints between accessory components and wall system.
- B. Section 081113 - Hollow Metal Doors and Frames.
- C. Section 083613 - Sectional Doors.

1.4 REFERENCE STANDARDS

- A. AISC 360 - Specification for Structural Steel Buildings 2022.
- B. ASCE/SEI 24 - Flood Resistant Design and Construction 2014.
- C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes 2021a.
- F. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing 2021.

- G. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality 2019.
- H. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process 2022.
- I. ASTM C920 - Standard Specification for Elastomeric Joint Sealants 2018.
- J. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink) 2020.
- K. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 2005 (Reapproved 2017).
- L. ASTM E1646 - Standard Test Method for Water Penetration of Exterior Metal Roof Panel Systems by Uniform Static Air Pressure Difference 1995 (Reapproved 2018).
- M. ASTM E1680 - Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems 2016 (Reapproved 2022).
- N. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen 2004 (Reapproved 2012).
- O. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 2000 (Reapproved 2023).
- P. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2023.
- Q. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a, with Editorial Revision (2023).
- R. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength 2020.
- S. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength 2022.
- T. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination 2020.
- U. AWS D1.1/D1.1M - Structural Welding Code - Steel 2020, with Errata (2022).
- V. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems 2018.
- W. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic) 2019.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week before starting work of this section.
 - 1. Post meeting record to project website.

1.6 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on profiles, component dimensions, fasteners.
- C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.
- D. Samples: Submit two samples of precoated metal panels for each color selected, 12by12 inch in size illustrating color and texture of finish.
- E. Delegated-Design Submittal: For metal building systems.
 - 1. Include analysis data indicating compliance with performance requirements and design data signed and sealed by the qualified professional engineer responsible for their preparation.

- F. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
- G. Letter of Design Certification: Signed and sealed by a qualified professional engineer. Include the following:
 - 1. Name and location of Project.
 - 2. Order number.
 - 3. Name of manufacturer.
 - 4. Name of Contractor.
 - 5. Building dimensions including width, length, height, and roof slope.
 - 6. Indicate compliance with AISC standards for hot-rolled steel and AISI standards for cold-rolled steel, including edition dates of each standard.
 - 7. Governing building code and year of edition.
 - 8. Design Loads: Include dead load, roof live load, collateral loads, roof snow load, deflection, wind loads/speeds and exposure, seismic design category or effective peak velocity-related acceleration/peak acceleration, and auxiliary loads (cranes).
 - 9. Load Combinations: Indicate that loads were applied acting simultaneously with concentrated loads, according to governing building code.
 - 10. Building-Use Category: Indicate category of building use and its effect on load importance factors.
- H. Sample warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.8 QUALITY ASSURANCE

- A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
 - 1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
 - 2. Comply with applicable code for submission of design calculations as required for acquiring permits.
 - 3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.
- B. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
 - 1. Not less than 5 years of documented experience
 - 2. Accredited by IAS in accordance with IAS AC472.
- C. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.9 WARRANTY

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide 20 year manufacturer warranty for Weathertightness for Standing-Seam Metal Roof Panels and Metal Panel Finishes.
 - 1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. A&S Building Systems, Inc.

2. Alliance Steel, Inc.
3. American Buildings Company, a Nucor Company
4. Behlen Manufacturing Co.
5. Butler Manufacturing Company; <>: www.butlermfg.com.
6. Ceco Building Systems; <>: www.cecobuildings.com.
7. Chief Buildings; <>: www.chiefbuildings.com/sle.
8. Inland Building Systems
9. Kirby Building Systems; <>: www.kirbybuildingsystems.com.
10. Metallic Building Company; <>: www.metallic.com.
11. Nucor Building Systems; <>: www.nucorbuildingsystems.com.
12. Red Dot Buildings
13. VP Buildings; <>: www.vp.com.
14. Substitutions: See Section 016000 - Product Requirements.

2.2 ASSEMBLIES

- A. Single span rigid frame.
- B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, intermediate columns, braced end frames, and end wall columns, and wind bracing.
- C. Secondary Framing: Purlins, Girts, Eave struts, Flange bracing, Sill supports, and Clips, and other items detailed.
- D. Wall System: Preformed metal panels of horizontal and vertical profiles, with sub-girt framing/anchorage assembly and insulation, and accessory components.
- E. Roof System: Preformed metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly and insulation, and accessory components.

2.3 PERFORMANCE REQUIREMENTS

- A. Installed Thermal Resistance of Wall System: R-value of 26.
- B. Installed Thermal Resistance of Roof System: R-value of 30.
- C. Design structural members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with design load schedule.
- D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.
- E. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

2.4 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A36/A36M.
- B. Structural Tubing: ASTM A500/A500M Grade B cold-formed.
- C. Plate or Bar Stock: ASTM A529/A529M, Grade 50.
- D. Anchor Bolts: ASTM F1554, Grade 36, Class 1A, with no preference for protective coating.
- E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1; galvanized to ASTM A153/A153M.
- F. Welding Materials: Perform in accordance with AWS D1.1/D1.1M.
- G. Primer: SSPC-Paint 20 zinc rich.
- H. Grout: ASTM C1107/C1107M; Non-shrink; premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.
 1. Minimum Compressive Strength at 48 Hours: 2,000 pounds per square inch.
 2. Minimum Compressive Strength at 28 Days: 7,000 pounds per square inch.

2.5 MATERIALS - WALLS AND ROOF

- A. Steel Sheet: ASTM A792/A792M aluminum-zinc alloy coated to AZ50/AZM150.
- B. Metal Building Type, Factory Applied, Vapor-Barrier Insulation Facings: Water vapor permeance no greater than 0.10 perm when tested in accordance with ASTM E96/E96M; flame spread index of 25 or less, and smoke developed index of 40 or less when tested in accordance with ASTM E84.

1. Manufacturers:
 - a. Thermal Design; Simple Saver, Insulation Systems: www.thermaldesign.com.
 - b. Substitutions: See Section 016000 - Product Requirements.
- C. Joint Seal Gaskets: Manufacturer's standard type.
- D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.
- E. Sealant: ASTM C920, elastomeric sealant with movement capability of at least plus/minus 50 percent; 100 percent silicone; for exposed applications, match adjacent colors as closely as possible.
- F. Roof Curbs: Insulated metal same as roofing, 1 1/2" inch thick, designed for imposed equipment loads, anchor fasteners to equipment, counterflashed to metal roof system.
- G. Trim, Closure Pieces, Caps, Flashings, Gutters, Downspouts, Rain Water Diverter, Fascias, and Infills: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.6 COMPONENTS

- A. Installed Thermal Resistance of Wall System: R-value of 13. Basis of Design to be **Thermal Design, SimpleSaver, Wall Liner System**.
- B. Installed Thermal Resistance of Roof System: R-value of 19. Basis of Design to be **Thermal, Design, Simple Saver, Roof Liner System**.
- C. Structural Performance: Metal building systems shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to procedures in MBMA's "Metal Building Systems Manual."
 1. Design Loads: As indicated on Drawings.
 2. Deflection and Drift Limits: No greater than the following:
 - a. Purlins and Rafters: Vertical deflection of **1/360** of the span.
 - b. Girts: Horizontal deflection of **1/360** of the span.
 - c. Metal Roof Panels: Vertical deflection of **1/240** of the span.
 - d. Metal Wall Panels: Horizontal deflection of **1/120** of the span.
 - e. Design secondary-framing system to accommodate deflection of primary framing and construction tolerances, and to maintain clearances at openings.
 - f. Lateral Drift: Maximum of **1/180** of the building height for wind and **1/240** for seismic.
- D. Seismic Performance: Metal building system shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- F. Structural Performance for Metal Roof and Wall Panels: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E1592:
 1. Wind Loads: As indicated on Drawings.
- G. Air Infiltration for Metal Roof Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E1680 or ASTM E283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).
- H. Air Infiltration for Metal Wall Panels: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E 283 at the following test-pressure difference:
 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

- I. Water Penetration for Metal Roof Panels: No water penetration when tested according to ASTM E1646 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
- J. Water Penetration for Metal Wall Panels: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 2.86 lbf/sq. ft. (137 Pa).
- K. Wind-Uplift Resistance: Provide metal roof panel assemblies that comply with UL 580 for wind-uplift-resistance class indicated.
 - 1. Uplift Rating: UL 60.
- L. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

2.7 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC 360 for plate, bar, tube, or rolled structural shapes.
- B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.
- C. Provide wall opening framing for doors, windows, and other accessory components.

2.8 FABRICATION - WALL AND ROOF PANELS

- A. Roofing: Standing-Seam, Vertical-Rib, Metal Roof Panels - **Basis of Design is SBS, VS-216:** Formed with interlocking ribs at panel edges and intermediate stiffening ribs symmetrically spaced between ribs; designed for sequential installation by mechanically attaching panels to supports using concealed clips located under one side of panels and engaging opposite edge of adjacent panels.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792/A 792M, structural quality, Grade 50, prepainted by the coil-coating process per ASTM A 755/A 755M.
 - a. Exterior Finish: Two-coat fluoropolymer.
 - b. Color: As selected by Architect from manufacturer's standard range.
 - 2. Clips: One-piece fixed to accommodate thermal movement.
 - 3. Joint Type: Mechanically seamed.
 - 4. Nominal Coated Thickness: 24 gage
 - 5. Panel Surface: Smooth with Striations in pan.
 - 6. Panel Width: 16 inches.
 - 7. Panel Length: Form Panels in continuous lengths for full length of detailed runs.
 - 8. Panel Seam Height: 2 inches
- B. Siding: Exposed-Fastener, Metal Wall Panels: Basis of Design is **SBS, PBU**.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, prepainted by the coil-coating process per ASTM A755/A755M..
 - a. Exterior Finish: Fluoropolymer two coat system.
 - b. Color: As selected by Architect from manufacturer's standard range.
 - 2. Nominal Thickness: 24 gage coated thickness with smooth surface.
 - 3. Panel Width: 36 inches.
 - 4. Panel Length: Provide panels in max length possible to suite project up to 35'-0" max.
 - 5. Panel Thickness: 3/4".
 - 6. Panel Location: As indicated on drawings.
- C. Siding: Exposed-Fastener, Metal Wall Panels: Basis of Design is **SBS, SBS-369**.
 - 1. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, prepainted by the coil-coating process per ASTM A755/A755M..
 - a. Exterior Finish: Fluoropolymer two coat system.
 - b. Color: As selected by Architect from manufacturer's standard range.
 - 2. Nominal Thickness: 24 gage coated thickness with smooth surface.
 - 3. Panel Width: 36 inches.
 - 4. Panel Length: Provide panels in max length possible to suite project up to 35'-0" max.

5. Panel Thickness: 3/4".
 6. Panel Location: As indicated on drawings.
- D. Soffit - Basis of Design is **SBS, CL12-2**: Provide factory-formed metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners and factory-applied sealant in side laps. Include accessories required for weathertight installation.
1. Material: Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A792/A792M, structural quality, Grade 50, prepainted by the coil-coating process per ASTM A755/A755M.
 - a. Finish: Match finish and color of metal roof panels.
 - b. Nominal Thickness: 24 gage coated thickness with smooth surface.
 2. Panel Width: 12"
 3. Panel Length: Provide panels in max length possible to suite project up to 10'-0" max.
 4. Panel Thickness: 1"
- E. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.
- F. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles. Back brace mitered internal corners with 3 inch thick sheet.
- G. Expansion Joints: Same material and finish as adjacent material where exposed, 2 inch thick, manufacturer's standard brake formed type, of profile to suit system.
- H. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.
- I. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.
- 2.9 FABRICATION - GUTTERS AND DOWNSPOUTS**
- A. Fabricate of same material and finish as roofing metal.
 - B. Form gutters and downspouts of Box Gutter profile and size indicated to collect and remove water. Fabricate with connection pieces.
 - C. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
 - D. Fabricate support straps of same material and finish as roofing metal, color as selected.
- 2.10 FINISHES**
- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.
- PART 3 EXECUTION**
- 3.1 EXAMINATION**
- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position
- 3.2 ERECTION - FRAMING**
- A. Erect framing in accordance with AISC 360.
 - B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
 - C. Set column base plates with non-shrink grout to achieve full plate bearing.
 - D. Do not field cut or alter structural members without approval.
 - E. After erection, prime welds, abrasions, and surfaces not shop primed.
- 3.3 ERECTION - WALL AND ROOF PANELS**
- A. Install in accordance with manufacturer's instructions.
 - B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
 - C. Fasten cladding system to structural supports, aligned level and plumb.
 - D. Locate end laps over supports. End laps minimum 2 inches. Place side laps over bearing.
 - E. Provide expansion joints where indicated.

- F. Use concealed fasteners.
- G. Install insulation and vapor retarder utilizing metal panel fastened to framing for attachment.
- H. Install sealant and gaskets, providing weather tight installation.

3.4 ERECTION - GUTTERS AND DOWNSPOUTS

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Apply bituminous paint on surfaces in contact with cementitious materials.
- C. Connect downspouts to storm sewer system.

3.5 TOLERANCES

- A. Framing Members: 1/4 inch from level; 1/8 inch from plumb.
- B. Siding and Roofing: 1/8 inch from true position.

END OF SECTION

DIVISION 21 – FIRE SPRINKLER SYSTEM

21-1 GENERAL:

- a) Hereinafter, all reference to “this contractor,” “the contractor,” etc., unless specifically preceded by a trade category, shall apply to the Sprinkler Contractor.
- b) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield, Suite 1000, Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Tyler Enserro.

21-2 SCOPE:

- a) Furnish all design, labor, materials, fabrication, equipment, and services necessary to provide a complete and operational automatic fire sprinkler system as specified herein and as required for satisfactory operation of the system. The building is an addition to an existing high school with new lobby, classrooms, auditorium, and stage. Light hazard, wet pipe, automatic sprinkler system with standpipes at stage. Addition shall have a new fire sprinkler service with new fire pump. Include calculations and provisions as needed a fire pump/jockey pump skid with autotransformer starting system and all required components per NFPA.
- b) The sprinkler system shall be installed in accordance with the latest edition of NFPA. This requirement does not relieve the Contractor from meeting the requirements set by Owner’s insurance company. All flow indicators, gongs, horns, etc., shall be included as part of this contract.

21-3 FEES AND PERMITS:

- a) The Contractor shall secure and pay for all permits, license, and inspections necessary in conjunction with this work. In addition, the contractor shall pay for all tap fees and equipment costs associated with the fire sprinkler system.

21-4 PROTECTION OF WORK:

- a) The Contractor shall take the necessary precautions required to protect his work as well as the work of other trades against any damages.

21-5 SUBMITTALS AND APPROVALS:

- a) All material submitted shall be contained in brochure type binders, clearly labeled, and identified. Each submittal shall be complete, with all items listed in schedule form shown type, manufacturer, catalog number, finish shop drawings or descriptive literature for the purpose of identifying the equipment, and Engineer’s reference number. Failure to comply with these requirements will result in return of submittal for resubmission.
- b) Contractors shall submit scaled layout drawings including, but not limited to, head locations, pipe sizes, locations, elevations, and slopes of horizontal runs, wall and floor penetrations, and connections. Indicate interface and spatial relationships between piping and proximate equipment. Show hanger locations. Plans shall be submitted prior to A/E for head locations approval.
- c) At project closeout, submit three (3) 1/8-inch scaled, dimensioned, record drawings to A/E of installed fire protection piping and equipment.
- d) The sprinkler system shall be a complete system as required by local authorities. All wiring required for the system shall be provided by the Contractor and shall be included in the submittal package. Submit to Agency having jurisdiction for approval. Submit one (1) approved copy, bearing stamp and/or signature of Agency having jurisdiction, before proceeding with installation.

- e) Submit certification upon completion of fire protection piping work which indicates that work has been tested in accordance with NFPA 13 and NFPA 14, and also that system is operational, complete, and has no defects.

21-6 CODES AND ORDINANCES:

- a) The Contractor shall comply with all requirements, regulations, code, ordinance, ruling or Fire Underwriters' requirements, NFPA, and Owner's insurance company applicable to this class of work. Furthermore, they shall include, but shall not be limited to, codes listed in other sections of these specifications.
- b) Provide fire protection products in accordance with UL standards: provide UL label on each product.
- c) Install fire protection systems in accordance with local regulations of fire department or fire marshal. Comply with local Fire Department/Marshal regulations for sizes, threading, and arrangement of connections for fire department equipment to standpipe systems.

21-7 ACCEPTABLE MANUFACTURERS:

- a) Viking, Reliable, Tyco or equal will be acceptable.

21-8 CAD FILE REQUESTS:

- a) CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office. Prior to receiving any CAD files, the contractor shall submit a drawing cost fee of \$50 per construction drawing up to a maximum of \$1500. In addition, the contractor must sign a Second Party User Agreement and Drawing Request Form (available upon request from our office) which must be forwarded back to the D/E office prior to any CAD files being released. BIM/Revit models will not be made available.

21-9 QUALIFICATION OF SPRINKLER CONTRACTOR:

- a) Fire protection work shall be installed by a firm with at least three (3) years of successful installation experience on projects with fire protection work similar to that required for project by a qualified Contractor (sprinkler fitter or per jurisdictional dictates). The Contractor's design shall be stamped by a Registered Professional Engineer licensed in the state of the project.

21-10 WATER SERVICE:

- a) Contractor shall include in his bid the installation of the required underground water service line at the location(s) indicated on the civil engineering drawings. The contractor must consult the City water department and local authorities, provide necessary materials and labor to conform to all local requirements and include the cost of all work and materials in connection with the service. This Contractor shall perform the necessary hydraulic calculations required to size the line in accordance with applicable provisions of NFPA including NFPA 13, 14 and 20.
- b) Existing water flow and pressure shall be verified with local water utility company prior to preparing shop drawings. Preliminary information received from the utility is as follows: Static Pressure: 88psi, Residual Pressure: 76psi, Test Hydrant Flow: 650gpm, Projected Available Flow: 1658gpm, Projected Main Flow: 4004gpm.
- c) Provide where indicated on plans watts model LF709, lead free, double-check backflow preventers with strainer and butterfly valves. Equal by Fabco, Hershey, Ames, or Wilkins will be acceptable.

21-11 TESTING AND FLUSHING OF SYSTEM:

- a) All piping shall be hydrostatically tested for a period of two (2) hours at not less than 200 psi pressure. If leaks appear, lines shall be drained, leaks repaired, and test repeated. No piping shall be concealed in any manner before being tested and approved.
- b) Tests shall be made in the presence of an inspector from the authorities having jurisdiction. The Owner shall be notified of time of all tests in advance of the date.

21-12 EQUIPMENT AND MATERIALS:

- a) All materials and equipment furnished as part of this contract shall be UL listed, Owner's insurance company approved, and in compliance with applicable provisions of the NFPA.
- b) No plastic piping will be allowed.
- c) Provide and install where shown on plans a fire pump package (estimated at 50HP) with vertical, inline pump; driver; controller; accessories and city pump bypass. The pumping unit shall be listed by Underwriters' Laboratories, Inc and shall meet all requirements of the National Fire Protection Association 20. The Fire Pump shall be designed to deliver 500 gpm when operating at delivery pressure of 100 PSI (estimated) with a 50 HP motor (estimated) with a suction pressure of 55 PSI. The pump shall also deliver not less than 150% of rated capacity at a pressure not less than 65% of rated pressure. The shut off pressure shall not exceed 120% of rated pressure. All equipment shall be mounted on single skid, piped complete, and wired for power feeds. All required valving, gauges, controllers, service rated disconnect switch, 65% auto transformer starter, jockey pump, circuit breakers, alarms, relays, etc. shall be included. Sizes are included for preliminary information only, the fire sprinkler contractor shall be responsible for any increased due to flow test and design calculations. The fire protection contractor shall include any change in costs for breakers, wiring, etc. for the electrical connections. Fire pumps shall be provided with 480 volt, 3-phase power feeds and 208V, 3-phase feed for jockey pump. Provide jockey pump and all required starters and controls as required. Include all required suction reducer, discharge tee, fitting, hose valves, header, pressure gauges, air/pressure release valves, etc for complete installation.
 1. Pump components shall be by single manufacturer – Armstrong, Aurora, Tyco, Pentair or approved equal.

21-13 SPRINKLER HEADS:

Unless indicated otherwise, sprinkler heads shall be as follows:

1. Exposed areas without ceilings-brass, unplated sprinklers.
2. Finished ceiling areas-concealed mount brass, unplated sprinklers with cover plate and trim. Provide white cover for all white lay-in or white gyp ceiling. Provided colored plate where surface is painted color other than white.
3. Areas with raised ceilings or no plenum space-sidewall quick response heads, all exposed parts polished chrome finish.
4. Provide dry type sprinkler heads in main entrance vestibule. Route piping along mullions and structure to space to minimize visibility.

Temperature rating of fusible plug or link of sprinklers shall be appropriate for the ambient conditions in the immediate areas.

Flexible stainless-steel hose with fittings for fire protection service that connect sprinkler heads to the branch lines in suspended ceilings shall be as allowed by the local jurisdiction and manufactured by FlexHead Industries.

1. Straight and angled hoses be 100%, type 304 stainless steel and shall be fully welded non-mechanical fittings, braided, leak-tested with minimum 1 inch (25.4 mm) true-bore internal corrugated hose diameter and limited to a maximum length of 3 feet and rated for 175 psi maximum pressure.
2. Shall attach to lay-in and hard ceilings with a multi-port style, galvanized ceiling bracket having self-securing integrated Snap-on clip ends that attach directly to the ceiling with tamper-resistant screws.
3. Flexible hose and fittings shall comply with NFPA-13 and perform in accordance with FM 1637 and UL 2443.
4. Equal by prior approval only.

Contractor shall furnish spare sprinkler heads identical to each type installed in accordance with the following schedule:

# Installed	# of Spares
Less than 300	6
More than 300	12

Spare sprinkler heads shall be mounted in emergency sprinkler cabinet. Cabinet shall be located in mechanical room. See drawings for location.

21-14 DESIGN AND CALCULATION:

- a) Contractor shall perform necessary calculations required for proper design and installation of the sprinkler system for the entire building addition. All design calculations and layout of the sprinkler system network shall be based on the specifications and accompanying drawings. Request for HVAC duct and equipment relocations shall be submitted to Engineer one (1) week before the bid opening date. No sprinkler pipe penetration will be allowed through HVAC duct system.

21-15 FIRE DEPARTMENT CONNECTIONS:

- a) Contractor shall provide remote fire department connection through exterior building wall. Provide type, threads, etc and all labeling as required by fire code, NFPA and local officials.

21-16 MISCELLANEOUS EXECUTION:

- a) All sprinkler heads shall be positioned approximately half way between rows of lights and at approximately center of ceiling tile. It shall be the responsibility of the sprinkler designing engineer to accommodate this requirement. Failure to comply with this requirement will result in return of submitted design for resubmission.
- b) Unless coordinated with other trades, all piping shall be installed within 6 inches of structure. Offset around obstacles as necessary and return piping to within 6 inches of structure as close to offset as possible. Branch piping shall be run between concrete stem and steel joists in rooms without ceilings.
- c) Sprinkler heads shall be installed in the center of ceiling tiles. Center shall mean within 2" of the center of the tile with all sprinkler heads aligned within room.

21-17 ELECTRICAL REQUIREMENTS:

- a) Electric tamper switches are not shown but are required wherever a shutoff valve is installed in the sprinkler system. The Contractor shall be responsible for providing the tamper switch and associated wiring to connect the fire alarm system. All wiring shall be in accordance with Division 26.
- b) The sprinkler contractor shall provide written verification and owner observance of operation of the notification system contacting the owner's monitoring service.
- c) All flow switches, gongs, horns, etc., required by the local code officials or authority with jurisdiction shall be included. All wiring shall be in accordance with Division 26.

21-18 STANDPIPE REQUIREMENTS:

- a) Standpipe system shall be hydraulically designed Class III in accordance with NFPA 14. Design shall be a combination sprinkler/standpipe system with 65-psi pressure required at topmost 1.5" hose connection. Provide standpipe system for stage as required by International Fire Code in conjunction with building fire sprinkler system.
- b) Provide standpipe connections in locations indicated on plans at stage or if not indicated, to comply with NFPA 14 and applicable regulations of governing authorities.
- c) Provide fire hose valve as required to comply with applicable regulations of governing authorities.
- d) Provide pressure regulators to limit static pressure at all standpipes connections per NFPA.
- e) For class III systems, furnish requirements to G/C as required by type, size of cabinet, and style of trim and to comply with manufacturer's instructions. Coordinate supervision requirements with fire alarm contractor.
- f) For class II or III systems, securely fasten hose racks to standpipe risers, and hose cabinets to structure, square and plumb, to comply with manufacturer's instructions.
- g) For class II or III systems, fire hose and rack assembly consisting of pin type swing rack, angle hose valve or gate valve, escutcheon (if in cabinet or at concealed standpipe), nipple, unlined linen fire hose, coupling, and hose nozzle. Hose connection shall be equipped with approved adjustable fog nozzle and mounted in cabinet for stage application.
- h) For class II or III systems, provide fire hose cabinets where indicated, or if not indicated, as required to comply with applicable regulations of governing authorities. Provide all equipment identification as required.

21-19 INSPECTIONS AND TESTING:

- a) The fire sprinkler system Engineer of Record shall inspect the sprinkler system installation for conformance with the sprinkler system design documents, the requirements of NFPA 13, and all codes applicable to the design and installation. Upon completion of the inspection, the Engineer of Record shall submit to the Contractor, Architect, and Engineer a report listing all deficiencies, conflicts, errors, etc., found during the inspection. The report shall be submitted no less than two (2) weeks prior to the scheduled date of substantial completion and shall bear the seal and signature of the Design Engineer. Work required addressing deficiencies, conflicts, errors, etc., listed in the fire sprinkler Engineer of Record's inspection report shall be performed by the Contractor and his own expense. As-built record drawings and hydraulic calculations shall be revised to include any and all additions and modifications and shall bear the seal and signature of the Engineer of Record.
- b) Upon completion of the fire sprinkler system installation, the Engineer of Record shall inspect and test the system in accordance with NFPA 13 requirements for system acceptance and system operational tests in the presence of the sprinkler system Design Engineer of record and a representative of the

authority having jurisdiction. The “Contractors Material and Test Certificate for Aboveground Piping” and a report of system’s operational tests shall be submitted with the fire sprinkler as-built record documents. The acceptance test certificates and operational test reports shall indicate the date of the tests and bear the signatures of the installing contractors performing the tests, and the Design Engineer of Record and the authority having jurisdiction witnessing the tests.

END OF DIVISION 21

DIVISION 22 – PLUMBING

22-1 CONTRACT DOCUMENTS:

- a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Plumbing Contractor and his subcontractors and material suppliers.

22-2 SPECIFICATION FORM AND DEFINITIONS:

- a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- c) “Provide” means furnish and install.
- d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- e) Architect/Engine hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield, Suite 1000, Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Tyler Enserro.
- g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.
- i) Plumbing Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.
- j) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

22-3 GENERAL EXTENT OF WORK:

- a) Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which M/C could have informed himself before bids were taken.
- b) M/C shall familiarize himself with equipment provided by other contractors, which require mechanical connections and controls.

22-4 LOCAL CONDITIONS:

- a) Visit site and determine existing local conditions affecting work in contract.

- b) Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

22-5 CODES, ORDINANCES, RULES, AND REGULATIONS:

- a) Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other Authorities Having lawful Jurisdiction (AHJ).
- b) Conform to latest editions and supplements of the following codes, standards, or recommended practices as adopted by the AHJ.

1. CITY CODES:

- A. 2006 International Plumbing Code.
- B. 2006 International Mechanical Code.
- C. 2006 International Building Code.
- D. 2006 International Fire Code.

2. SAFETY CODES:

- A. National Electric Safety Code Handbook H30 – National Bureau of Standards.
- B. Occupational Safety and Health Standards – Department of Labor.
- C. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.

3. NATIONAL FIRE CODES:

- A. NFPA 54 Gas Appliance and Gas Piping Code.
- B. NFPA 70 National Electric Code – 2005 Edition.
- C. NFPA 89M Clearances, Heat Producing Appliances.
- D. NFPA 90A Air Conditioning and Ventilation Systems.
- E. NFPA 91 Blower and Exhaust Systems.
- F. NFPA 101 Life Safety Code – 2012 Edition.

- c) Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:

- 1. AGA – The American Gas Association Laboratories.
- 2. ASME – American Society of Mechanical Engineers.
- 3. NSF – National Sanitation Foundation.
- 4. UL – Underwriters Laboratories Inc.

- d) Drawings and Specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, Contractor shall

execute work in accordance with such ordinances, laws, codes, rules, or regulations without increased cost to Owner, but not until he has referred such variances to A/E for approval.

- e) M/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules, or regulations. Keep a written record of all permits and inspection certificates and submit two (2) copies to A/E with request for final inspection.

22-6 CONTRACT CHANGE:

- a) Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
- b) Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.
- c) All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustment factors. If proposals are not itemized, they will be rejected and returned for proper submittal.
- d) The maximum allowable profit for any change order shall be ten percent (10%).
- e) See Example below:

PRICING SHEET

Project:	Cassville Performance Arts Center	Date:	March 1, 2023
Location:	Cassville, Missouri	Estimator:	Jane Doe
Labor Rate:	\$22.00		

		Unit	Material	Man Hours	Total	Material
Material	Units	Measure	Per Unit	Per Unit	Man Hours	Total
6" tee	1	ea.	\$45.00	2.000	2.0	\$ 45.00
Less 6" ell	1	ea.	\$30.00	0.000	0.0	\$ 30.00
6" sch 40 pipe	22	ft.	\$10.43	0.253	3.8	\$ 56.46
6" cap	1	ea.	\$11.00	1.500	1.5	\$ 11.00
6" hanger	1	ea.	\$12.00	0.400	0.4	\$ 12.00
4" saddle weld	1	ea.	\$0.00	1.200	1.2	\$ 0.00
4" sch 40	18	ft.	\$4.44	0.183	3.3	\$ 79.92
4" ell	3	ea.	\$13.39	2.000	6.0	\$ 40.17
4" hanger	3	ea.	\$8.00	0.300	0.9	\$ 24.00
4" weld	1	ea.	\$3.00	1.000	1.0	\$ 3.00
1.5" cond sch 80	21	ft.	\$1.63	0.080	1.7	\$ 34.23
1.5" ell	3	ea.	\$4.00	0.400	1.2	\$ 12.00
1.5" tee	1	ea.	\$5.00	0.600	0.6	\$ 5.00
1.5" weld	1	ea.	\$3.00	0.400	0.4	\$ 3.00
0.75" F & T trap	1	ea.	\$73.00	0.500	0.5	\$ 73.00
0.75" strainer	1	ea.	\$12.00	0.500	0.5	\$ 12.00

0.75" XH nipples	4	ea.	\$7.70	0.100	0.4	\$ 30.80
0.75" unions	2	ea.	\$3.18	0.300	0.6	\$ 6.36
0.75" cap	1	ea.	\$0.65	0.100	0.1	\$ 0.65
0.75" pipe sch 80	10	ft.	\$0.72	0.400	0.4	\$ 7.20
0.75" tee	1	ea.	\$1.50	0.300	0.3	\$ 1.50
0.75" ell	3	ea.	\$0.95	0.200	0.6	\$ 2.85
0.75" hanger	2	ea.	\$2.50	0.200	0.4	\$ 5.00
SUBTOTAL					28.74	\$618.47
SALES TAX				6.125%		\$37.88
LABOR	28.4	MH	\$22.00			\$624.80
5% OVERHEAD						\$64.06
8% PROFIT						\$107.62
TOTAL						\$1,452.83

22-7 LOCATIONS AND INTERFERENCES:

- a) Locations of equipment, piping, and other mechanical work are indicated diagrammatically by mechanical drawings. Determine exact locations on job, subject to structural conditions, work of other contractors, access requirements for installation and maintenance, and to approval of A/E.
- b) Study and become familiar with contract drawings of other trades and in particular the general construction plans and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.
- c) Any pipe, apparatus, appliance, or other item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the Contractor, his subcontractor, or his workmen shall be restored as specified for new work.
- d) Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

22-8 SYSTEM PERFORMANCE:

- a) Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment and all required programming installed under this Specification.
- b) Contractor shall be responsible for all work as required by phasing of construction for intended use by the owner as applicable.

22-9 WARRANTY:

- a) M/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this Specification Division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.

- b) Where manufacturers' warranties expire during the one (1) year warranty period, one (1) year warranty period is defined as year after date of substantial completion. M/C shall include provisions for extending warranty for the full one (1) year period and shall cost for warranty extension in his base bid.
- c) M/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at M/C's expense.
- d) The above warranty shall not supersede any separately stated warranty or other requirements by law or by these Specifications.
- e) If the Architect's specification includes a warranty that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

22-10 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS:

- a) The intent of these Specifications is to allow ample opportunity for M/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- b) Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.
- c) In general, these Specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and Specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these Specifications or in subsequent addenda. Where other than first named products are used for M/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, that will meet or exceed the Specifications and are acceptable to the D/E.
- d) Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- e) **PRIOR TO RECEIPT OF BIDS, IF M/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.**
- f) Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.
- g) In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical/electrical service requirements necessary to accommodate such substitution, whether such affected elements are under this contract or under separate contracts.

- h) Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, M/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, M/C shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.
- i) After execution of contract, substitution of product brands for those named in Specifications will be considered, only if; 1) request is received within 30 days after contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or 2) Owner requests consideration be given to substitute brands.

22-11 SHOP DRAWINGS, OPERATION, AND MAINTENANCE INSTRUCTION:

- a) Unless noted differently in the general requirements of the specifications, M/C shall furnish a minimum of six (6) sets of shop drawings of all materials and equipment, Engineer will retain one (1) set.
- b) Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc. that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these Specifications, or plan sheet number, when item does not appear in Specifications. Where equipment submitted does not appear in base Specifications of specified equivalent, mark submittals with applicable alternate numbers, change order numbers, or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- c) M/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear M/C approval stamp which shall indicate that M/C has reviewed submittals and that they meet Specification and/or drawing requirements. M/C's submittal review shall specifically check for, but not limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting M/C's approval shall be returned to his supplier for resubmittal.
- d) No shop drawing submittals will be considered for review by the A/E without M/C's approval stamp, or that have extensive changes made on the original submittal as a result of Contractor's review. All comments or minor notations on shop drawings shall be flagged as follows to indicate originator of comment or notation: 1 Contractor, 2 Construction Manager, 3 Architect, and 4 Engineer.
- e) A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without M/C's review and approval stamp. A letter will be sent to M/C by either the Architect or Engineer indicating receipt of an improper submittal. M/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by M/C or supplier for 22 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.
- f) A/E's review of shop drawings will not relieve M/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing to Owner or his representative, nor shall it relieve M/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be M/C's responsibility.
- g) Operating and Maintenance Instructions:
 - 1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.

2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.
3. Contractor shall provide all final documents including drawings, shop drawings, etc. in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this Specification, will also be required at closeout.

22-12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS:

- a) Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. To determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.
- b) Where the contractor proposes to use different equipment that results in significant difference in routing or space considerations than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

22-13 CAD/BIM FILE REQUESTS:

- a) CAD files and/or BIM models (only where created as part of the project design) are the property of the D/E and are only available upon documented written request. Prior to receiving any CAD files or models, the contractor shall submit a drawing cost fee of \$50/drawing up to a maximum \$1500 (BIM models are \$1500). In addition, the contractor must sign a Third Party User Agreement and Drawing Request Form which must be forwarded to the D/E office prior to any CAD files being released. This form is available from the D/E upon request.

22-14 CUTTING AND PATCHING:

- a) M/C shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- b) Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- c) Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

22-15 MUTILATION:

- a) Mutilation of building finishes, caused by installation of mechanical equipment, fixtures, piping, and other mechanical devices shall be repaired at M/C's expense to approval of Architect.

22-16 EXCAVATION AND BACKFILL:

- a) Perform necessary excavating to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. as required and remove same at completion of work. Perform excavation in accordance with appropriate section of these Specifications, and in compliance with OSHA Safety Standards.

- b) Excavate trenches of sufficient width to allow ample working space, and a minimum of 6", and no deeper than necessary, for installation work.
- c) Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footings with selected earth or sand and tamp to compaction required by A/E. Mechanically tamp backfill under concrete and paving in 6-inch layers to 95 percent standard density.
- d) Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moisten as required for specified compaction density. Dispose of excess earth, rubble, and debris as directed by Architect.
- e) When available, refer to test-hole information on Architectural drawings or specifications for types of soil to be encountered in excavation in base bid.
- f) Trenches shall be installed to have a bedding of natural or artificial graded fixture of crushed gravel or sand with 100% passing a 1 inch sieve and not more than 8% passing a #200 sieve. All depressions shall be filled with tamped sand backfill. Place and compact backfill of sub-base material free of particles larger than 1" over piping. Compact each 6" layer at 85% density. Install warning tape directly above piping outside the building at 12" below grade.
- g) All buried PVC DWV piping systems shall be installed in accordance with ASTM D 2321. Submit pictures of the underground pipe installation to the design engineer prior to backfilling.
- h) Gravel for use of backfill will not be accepted unless approved by Engineer.
- i) Notify Engineer two (2) business days prior to plumbing inspection by AHJ so that Engineer can visually inspect piping prior to backfill.

22-17 SETTING, ADJUSTMENT, AND EQUIPMENT SUPPORTS:

- a) Work shall include mounting, alignment, and adjustment of systems and equipment.
- b) Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown, specified, or required by E/M's installation instructions.
- c) Provide concrete bases for all floor and slab mounted equipment. Refer to drawings for required base type and size. Provide 3.5-inch high base where base is not shown on drawings.

22-18 START-UP, CHANGE-OVER, TRAINING, AND OPERATIONAL CHECKS:

- a) M/C shall perform initial start-up of systems and equipment and shall provide necessary supervision and labor to make first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.

22-19 PAINTING OF MATERIALS AND EQUIPMENT:

- a) Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) finish coats with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by A/E.
- b) After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
- c) Where extensive refinishing of factory applied finishes are required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

d) Paint all exterior natural gas piping with one (1) primer coat and two (2) finish coats.

22-20 MAINTENANCE OF SYSTEMS:

a) M/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract.

22-21 STERILIZATION OF DOMESTIC WATER SYSTEM:

a) After final pressure testing of distribution system, thoroughly flush entire system with water until free of dirt and construction debris. Fill system with solution of liquid chlorine or hypochlorite of not less than 50 ppm. Retain treated water in system until tests indicate non spore-forming bacteria have been destroyed or for 24 hours, whichever is greater.

b) All points in system shall have at least 10 ppm of solution at end of retention period.

c) When time and concentration have been met, drain system and flush with fresh domestic water until residual cleaning solution is less than 1.0 ppm. Open and close each valve in system six (6) times during flushing operation.

d) Test samples taken from several points in system shall indicate absence of pollution for 48 hours. Repeat sterilization as required. Acceptance of system will not be given until satisfactory bacteriological results are obtained.

22-22 PIPING IDENTIFICATION:

a) Identify piping in mechanical rooms, above ceilings, open pipe chases, tunnels and other places where piping is accessible for operation and maintenance by painting with identification colors and with pressure sensitive pipe markers.

b) Place piping markers so they can be easily read from operating position and floor.

c) Mark piping with marker and a 3-inch-wide band of identification color around circumference of pipe in lieu of painting complete pipe or pipe covering.

d) Lettering on marker shall be at least 1-inch-high block type in contrasting color. An arrow indicating flow direction shall be painted next to each marker. Where markers occur on parallel groups of piping, they shall be neatly lined up.

e) See Schedule.

PIPING IDENTIFICATION SCHEDULE

Service	Letter Wording	Marker Color	Letter Color
Domestic Cold Water	Domestic Cold Water	Green	White
Domestic Hot Water	Domestic Hot Water	Yellow	Black
Domestic Hot Water Return	Hot Water Return	Yellow	Black
Natural Gas	Natural Gas	Yellow	Black
Fire Protection Water	Fire Protection Water	Red	White
Fire Sprinkler Water	Fire Sprinkler Water	Red	White

22-23 VALVE IDENTIFICATION:

- a) Mark all valves located above ceiling with designation on ceiling tile directly below the valve as directed by the owner.

22-24 PIPE SLEEVES:

- a) Provide proper type and size pipe sleeves and install in walls or floors and where otherwise noted. Sleeves are not required for supply and waste piping through wall supporting plumbing fixtures or for cast iron soil pipe passing through concrete slab on grade except where penetrating a membrane waterproof floor. Sleeves shall not be provided in rated floors requiring fire seals.
- b) Each sleeve shall be continuous through wall, floor, or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved. Sleeves shall be required through floors subject to flooding such as toilet rooms, equipment rooms, and kitchens. The contractor shall have the option of:
 - 1. Providing a cast iron sleeve with integral flanges extending 1-inch above finished floor. Sleeve shall be cast in concrete when floor is poured. Annular space between sleeve and pipe shall be filled with Kaowool.
 - or
 - 2. Provide core-drilled opening in concrete with Thunderline Link-Seal or Calpico Sealing Linx between piping and opening.
- c) Sleeves passing through floors with waterproof membranes shall be core-drilled and sealed with Thunderline Link-Seal or Calpico Sealing Linx.
- d) Sleeves passing through walls with waterproof membranes shall be sealed with Thunderline Link-Seal or Calpico Sealing Linx.
- e) Pipe insulation shall run continuous through pipe sleeves with 0.25-inch minimum clearance between insulation and pipe sleeve. Provide metal jackets over insulated pipes passing through fire walls, floors, and smoke partitions. Jacket shall be 0.018 stainless steel extending 12 inches on either side of barrier and secured to insulation with 0.375-inch-wide band. Provide Kaowool fire master bulk packing between sleeve and metal jacket. Packing thickness shall be sized per manufacturer's recommendation for maintaining the integrity of the fire wall/floor or smoke partition. Fire protection system shall be rated per ASTM E 119. Equivalentents to Kaowool are 3M, Flame Stop, or Flame Safe.
- f) Where piping passes through walls serving as air plenums or chases, seal annular space between pipe and sleeve air tight with Kaowool Firemaster Bulk Packing.

22-25 WELDING:

- a) Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society AWS B3.0 and ANSI Z49.1.
- b) Welding shall be done only by welders who have successfully passed welder qualification tests in previous 12 months for type of welding required. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three (3) copies of a list of welders who will work on project listing welder's code, date, and types of latest qualification tests passed by each welder.
- c) Welded joints shall be fusion welded in accordance with Level AR3 of AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing." Welders qualified under National Certified Pipe Welding Bureau will be acceptable.

- d) Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

22-26 PIPING MATERIALS AND FITTINGS:

- a) Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturer's name and weight. All materials listed may not be required on this project. See piping material schedules, on drawings, for materials to be used for each piping system. Piping materials shall be as follows:
1. Cast Iron Bell and Spigot Soil Pipe:
 - A. Pipe and fittings shall be gray cast iron bell and spigot ends with lead grooves and spigot and beads. Pipe and fittings shall be coated inside and out with asphaltum preservative and meet requirements of current Cast Iron Soil and Pipe Institute CISPI HS-67 and ASTM A 74-69.
 - B. Seal joints with lead and oakum in accordance with current ANSI A40.8.
 - C. (Optional) Seal joints with neoprene pipe gaskets meeting current ASTM C 564-68.
 - D. Pipe and fittings by Tyler Pipe, Charlotte, Central Foundry, or Wheatland Tube Company
 - E. All cast iron soil pipe and fittings shall be marked with the Collective Trademark of CISPI and be listed by NSF International.
 2. Hubless Cast Iron Soil Pipe:
 - A. Pipe and fittings shall be gray cast iron with spigot bead and positioning lug. Pipe and fittings shall be coated inside and out with asphaltum preservative and shall meet requirements of current CISPI 301-69T.
 - B. Pipe joints shall be no-hub joint couplings consisting of neoprene rubber sleeve, stainless steel shield, and clamp assembly.
 - C. Pipe and fittings by Tyler Pipe, Charlotte, Central Foundry, or Wheatland Tube Company.
 - D. All cast iron soil pipe and fittings shall be marked with the Collective Trademark of CISPI and be listed by NSF International.
 3. Carbon Steel Pipe (0.5 inches through 2.5 inches):
 - A. Provide continuous weld or electric resistance welded carbon steel pipe conforming to ASTM A120 or A53, as scheduled.
 - B. Pipe joints shall be threaded conforming to ANSI B2.1, beveled for welding, or grooved for use with Victaulic couplings.
 - C. Pipe by Armco, Youngstown, United States Steel, or equal.
 4. Carbon Steel Pipe (3 inches and above):
 - A. Provide seamless continuous or electric weld carbon steel pipe conforming to ASTM A120 or A53, as scheduled.
 - B. Pipe ends shall be beveled for welding or grooved for use with Victaulic couplings.

- C. Pipe by Armco, Youngstown, United States Steel, or equal.
5. Polyvinyl Chloride (PVC) Pipe:
- A. Provide Type 1, Grade 1 PVC pipe conforming to requirements of current ASTM D 1785 for pressure piping as scheduled. Pipe shall be approved by NSF for potable water.
 - B. Provide Type 1, Grade 1 PVC pipe conforming to requirements of current ASTM D 2665 for DWV piping as scheduled. Cellular core PVC piping will not be approved.
 - C. Piping for pressure piping shall have plain ends for socket type fittings.
 - D. Pipe by Chemtrol, Charlotte, Tyler, Pipelife, Cabot, or equal.
6. Copper Tube:
- A. Provide hard temper copper water tube conforming to requirements of current ASTM B 88. Tubing shall be Type K, L, or M as listed in schedule.
 - B. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.
 - C. Pipe by Cerro, Chase, Mueller, Revere Copper, or equal.
7. Copper Tube Type ACR:
- A. Provide hard temper nitrogenized copper refrigerant tube conforming to requirements of current ASTM B 88. Tube shall be Type L or K as listed in schedule.
 - B. Tubing joints shall be brazed or grooved joints shall be manufactured to copper-tube dimensions. (Flaring tubing ends to accommodate alternate sized couplings is not allowed.)
 - C. Pipe by Cerro, Mueller, or equal.
8. Chlorinated Polyvinyl Chloride (CPVC) Pipe:
- A. 2" and smaller to be Copper Tube Size (CTS) CPVC pipe and fittings – Conforming to ASTM D2846, FlowGuard Gold CPVC compound material and shall meet a cell class rating of 24448 as defined by ASTM D1784, and shall be certified/labeled by NSF International for use in potable water systems.
 - i. FlowGuard Gold material shall meet the flame spread / smoke developed rating of 25/50 as tested in accordance with ASTM E 84, and shall be tested empty and have third party test data available confirming material meets the 25/50 requirement.
 - B. 2-1/2" and larger to be schedule 80 IPS Corzan® pipe and fittings – The pipe compounds shall meet cell class rating of 24448 for piping up to 8" size and a cell class rating of 23447 for piping larger than 8" as defined by ASTM D1784. Piping shall be NSF International certified for potable water use, CPVC pipe and fittings shall also conform to the following:
 - i. Pipe shall meet or exceed the requirements of ASTM F441 in schedule 80 IPS.
 - ii. Corzan material up to 6" size shall meet the general intent of the flame spread / smoke developed rating of 25/50 as a water filled pipe as tested in accordance with ASTM E 84, and shall third party test data available confirming material meets the 25/50 requirement.
 - C. Pipe by Charlotte, Cresline, Genova, GF Harvel, Bow, IPEX and Nibco

22-27 PIPE FITTINGS:

a) Pipe fittings used throughout project shall be proper type for installation method used and shall be compatible with piping system materials. Fittings listed in piping material schedule shall conform to the following specifications:

1. Carbon Steel Welding Fittings:
 - A. Provide carbon low alloy seamless steel welding fittings conforming to current ANSI B16.9 and ASTM A234.
 - B. Fittings by Grinnell, Midwest, or equal.
2. Nickel Copper Alloy Steel Welding Fittings:
 - A. Provide nickel copper alloy steel welding fittings conforming to ANSI B16.9 and ASTM A234.
3. Branch Connection Welding Fittings:
 - A. Provide carbon steel weldolet fittings conforming to ANSI B16.9, B16.11, B31.1.0, and ASTM A105, Grade 11.
 - B. Fittings by Bonney Forge or equal.
4. Branch Connection Welding to Screwed Fitting:
 - A. Provide carbon steel threadolet fitting conforming to ANSI B16.9, B16.1.1, B31.1, and ASTM A105, Grade 11.
 - B. Fittings by Bonney Forge or equal.
5. Grooved End Pipe Coupling:
 - A. Provide couplings consisting of two ductile iron housings conforming to ASTM Specification A536, Grade 65-45-12, with elastomer gasket and track type bolts conforming to ASTM Specification A 183 and A449.
 - B. Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.
 - i. 2" through 6": Installation-Ready, for direct stab installation without field disassembly, with grade EHP gasket rated to +250 deg F / 120 deg C. Victaulic Style 107.
 - ii. Victaulic Zero-Flex Style 07.
 - C. Flexible Type: For use in locations where vibration attenuation and stress relief are required. Three flexible couplings may be used in lieu of a flexible connector. The couplings shall be placed in close proximity to the source of the vibration. Victaulic Installation-Ready Style 177 or Style 77.
 - D. Couplings by Victaulic Company or "Gruvagrip" by Gustin-Bacon.
8. Wrought Copper Fittings:
 - A. Provide wrought solder joint copper tube fitting conforming to ANSI B16.22.
 - B. Fittings by Chase, Nibco, or equal.

9. Cast Bronze Fittings:

- A. Provide cast bronze solder joint fittings conforming to ANSI B16.18.
- B. Fittings by Chase, Nibco, or equal.

10. PVC, DWV Fittings:

- A. Provide PVC, DWV socket fittings conforming to ASTM D 3311 and D 2661.
- B. Solvent cement of socket fittings shall conform to ASTM D 2235.
- C. Fittings by Chemtrol, Charlotte, Tyler, or equal.

11. PVC, Schedule 40 Pressure Fittings:

- A. Provide NSF rated, Schedule 40, PVC socket fittings conforming to ASTM D 2466.
- B. Solvent cement of socket fittings shall conform to ASTM D 2564.
- C. Fittings by Tyler, Charlotte, or equal.

12. CPVC, Schedule 80 Pressure Fittings:

- A. FlowGuard Gold pipe and fittings shall be assembled using One-Step solvent cement process. All socket type joints shall be assembled employing solvent cements that meet or exceed the requirements of ASTM F493. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be listed by NSF International for use with potable water
- B. Provide Corzan pipe and fittings shall be assembled using Two-Step solvent cement process. All socket type joints shall be assembled employing solvent cements that meet or exceed the requirements of ASTM F493 and primers that meet or exceed the requirements of ASTM F656. The standard practice for safe handling of solvent cements shall be in accordance with ASTM F402. Solvent cement shall be listed by NSF International for use with potable water.
- C. Corzan CPVC schedule 80 fittings shall carry a pressure rating as listed by Plastics Pipe Institute (PPI). This Corzan CPVC schedule 80 IPS compound shall be pressure rated in accordance with ASTM D2837 and PPI – TR-3 and have a hydrostatic design bases of 4,000 psi at 72°F and 1,000 psi at 180 °F as listed in PPI publication TR-4.
 - (a) Schedule 80 – Socket type fittings shall meet or exceed the requirements of ASTM F439.
 - (b) Schedule 80 – Threaded type fittings shall meet or exceed the requirements of ASTM F437.
- D. Pipe by Charlotte, Cresline, Genova, GF Harvel, Bow, IPEX and Nibco.

22-28 INSULATING UNIONS AND FLANGES:

- a) Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturer's name and pressure class rating. Unions and flanges shall be as follows:
 - 1. Steel pipe to steel pipe screwed end:

- A. Provide Stockham malleable iron No. 693-0.5 insulating union with high dielectric strength insulating sleeve and gasket.
- 2. Steel pipe to steel pipe flanged end:
 - A. Provide two (2) weld neck flanges of proper pressure rating insulated on both sides with Central or Klingerit Flange Insulation Kit.
- 3. Iron or steel pipe to copper pipe:
 - A. Provide Epco dielectric union or flange with screwed or solder joint as required. Union shall have 250 psi rating and flange 175 psi rating at 190 deg F. Equal by Capitol Manufacturing, Central Plastics and Watts Regulator.
 - B. Dielectric nipples shall not be used.

22-29 UNIONS:

- a) Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.
- b) Provide Stockham brass seat unions of material and pressure rating required by piping system.
- c) Where piping systems of dissimilar materials are jointed together, provide proper insulating union as specified under this Specification.

22-30 BACKFLOW PREVENTERS:

- a) Provide where indicated on plans for fire sprinkler system valves 2.5" and larger a Watts Model LF709 double-check backflow preventer with strainer and ball valves (2.5 inches) and butterfly valves (larger than 2.5 inches). Equal by Febco, Hershey, Ames, or Wilkins will be acceptable.
- b) Provide where indicated on plans for valves 2.5" and larger a Watts Model LF909 reduced-pressure, backflow preventer with strainer, drip cup, and ball valves (2.5 inches) or butterfly valves (over 2.5 inches). Equal by Febco, Hershey, Ames, or Wilkins will be acceptable.

22-31 PIPING INSTALLATION:

- a) Piping systems materials and installation shall conform to the following standards and codes:
 - 1. System: Natural Gas Piping Code: ANSI Standard B31.2 "Fuel Gas Piping"
 - 2. System: Plumbing System Piping Code: International Association of Plumbing and Mechanical Officials "Uniform Plumbing Code"
- b) Pipe sizes indicated on plans and as specified refer to nominal size in inches for steel pipe, cast iron pipe, and copper tubing unless otherwise indicated. In no case shall piping smaller than size specified be used.
- c) Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc. as recommended by manufacturer and as specified and detailed on drawings. Verify construction types and provide proper hangers, inserts, and supports in accordance with manufacturer's load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide solid type hangers and supports where pipe travel exceeds manufacturer's recommendations for fixed hanger and supports. Provide copper plated hangers and supports for suspension of un-insulated copper tubing lines.

- d) Provide escutcheon plates on all piping penetrations of exposed walls. Paint to match exposed surface.
- e) Install all piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping systems. All piping shall be concealed unless noted otherwise. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves, and fittings used are not exceeded during normal operation or testing of piping system.
- f) Provide piping materials and wall thickness for specific piping systems as listed in piping schedules in Section 22. Steel piping systems 2.5 inches and under shall be threaded pipe fittings. Steel pipe systems 3 inches and above shall be welded end pipe and fittings unless required otherwise by Code.
- g) Where listed in piping schedules or noted on drawings, provide 2 inches and larger with Victaulic grooved couplings as specified.
- h) Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed end valves with union adjacent to valve unless valve can be otherwise easily removed from line. Provide unions on identical sizes of equipment for which one replacement item to be installed between unions without making any piping changes.
- i) Piping fitting materials for specific piping systems shall be as listed in piping schedule. Fittings shall be approved factory made type with threaded or weld ends as required. Fitting pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.
- j) All pipe threads shall meet ANSI B2.1 for taper threads. Lubricate pipe threads with Astroseal Teflon thread sealant and lubricating compound applied full strength. Powdered or made up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.
- k) Welded pipe joints shall be made by qualified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe fitting ends shall be beveled a minimum of 30 degrees prior to welding.
- l) Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.
- m) Soft soldered socket type joints shall be made with 95-5 tin-antimony solder as required by temperature and pressure rating of piping systems. Solder socket joints shall be limited to systems containing nonflammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock or vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.
- n) Make changes in piping size and direction with approved factory made fittings. Steel pipe and fittings suitable for at least 125 psi working pressure or of pressure rating required for maximum working pressure of system, whichever is greater.
- o) Where pipe sizes of header or branch water supply piping do not appear on drawings, size piping to plumbing fixtures as follows:

FIXTURE TYPE	MAXIMUM QUANTITY		
	OF FIXTURES	PIPE CW	SIZE HW
Water Closet (Flush Valve)	1	1.25"	--
Water Closet (Flush Valve)	2	1.5"	--

FIXTURE TYPE	MAXIMUM QUANTITY		
	OF FIXTURES	PIPE CW	SIZE HW
Water Closet (Flush Valve)	5	2"	--
Water Closet (Flush Valve)	10	2.5"	--
Lavatory	1	0.5"	0.5"
Lavatory	3	0.75"	0.75"
Lavatory	6	1"	1"

22-32 VALVES AND INSTALLATION:

- a) Install necessary valves within piping systems to provide required flow control and to allow isolation for inspection, maintenance, and repair of each piece of equipment or fixture, and on each main and branch service loop. For application of specific valve types see Section 22 of this Specification.
- b) Valves 2.5 inches and smaller have solder, socket weld, flanged, or screwed end connections as required by piping materials unless otherwise specified or shown on drawings. Install union connection in the line within 2 feet of each screw end valve unless valve can be otherwise easily removed from line. Valves 3 inches and over shall have flange end connections or butt weld ends as scheduled. Optional Victaulic grooved valves may be used where scheduled.
- c) Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance.
- d) Non-rising stem valves shall not be installed at any point in the piping systems. With permission of A/E, non-rising stem valves may be installed at particular points where space is restricted.
- e) Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.
- f) Valves shall be the same size as piping shown on drawings. Do not reduce valve size.
- g) Equivalent gate, butterfly, globe, and plug valves listed on current comparison charts of specified valve manufactured by Crane, Centerline, NIBCO, Kennedy, Keystone, Powell, or Victaulic will be acceptable.
- h) Equivalent balancing valves by Taco, Flowset, Thrush, or Illinois will be acceptable.
- i) Equivalent automatic flow control valves by Flow Design, Hays Fluid Control, Griswold and Siemens.

22-33 VALVES:

- a) Ball valves shall be scheduled as Type "BLV" valves. Valve specifications by type number shall be as follows:

TYPE NO	SPECIFICATION
BLV-1	2.5-inch valves and smaller for domestic water: Apollo Series 77CLF-X40, bronze (MSS SP-110, IAPMO IGC-157 or NSF/ANSI 61-8) (lead-free) full port ball valve 600 psi-WOB, Teflon seats, 316 stainless steel ball and stem with insulated handle and soldered, grooved or screwed ends. Provide stem extension for handle as required for insulation of valve body.
BLV-2	3 and 4-inch valves for domestic water: Apollo Series 70LF-X40, bronze (MSS SP-110, IAPMO IGC-157 or NSF/ANSI 61-8) (lead-free) full port ball valve 600 psi-

WOB, RPTFE seats, 316 stainless steel ball and stem with insulated handle and grooved or threaded ends. Provide stem extension for handle as required for insulation of valve body.

- b) Plug valves shall be scheduled as Type "PLV" valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
PLV -1	1-inch valves and smaller: Hays 7400 Series iron body gas cock, 175 psi-WOG bronze plug washer and nut, screwed ends.
PLV-2	1.25-inch valves through 2.5-inch valves: Homestead Fig. 651, semi-steel lubricated plug valve, 200 psi-WOG, coated plug, short pattern screwed ends. Provide complete with standard pattern cast handle.
PLV-3	3-inch valves through 10-inch valves: Homestead Fig. 652 semi-steel lubricated plug valve, 200 psi-WOG, coated plug, short pattern, flanged ends. Provide complete with standard pattern cast or pipe handle as required.

- c) Balancing valves shall be scheduled as Type "BAV" valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
BAV-1	4-inch valves and smaller: Bell and Gossett Model CB circuit setter balance valve, bronze body, 125 psi-WP at 250 deg F precision machined orifice calibrated position indicator, meter connections with built-in check valves flanged. Provide complete with polyurethane insulation cover.

- d) Silent check valves shall be scheduled as Type "SCV" valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
SCV-1	2-inch valves and smaller: NIBCO T-480-Y bronze check valve, 250 psi-WOG, stainless steel spring, stainless steel stem, Teflon disc and seat ring, screwed or solder ends.
SVC-2	2-inch valves and smaller: NIBCO T-413-Y-LF, lead-free, bronze body, bronze trim check valve, 300 psi-WOG screwed end.

- e) Automatic flow control valves shall be scheduled as Type "AFV" valves. Valve specifications by type number shall be as follows:

TYPE NO.	SPECIFICATION
AFV-1	2-inch valves and smaller: Flow Design Inc. AutoFlow, Model AC automatic flow control valve, brass body, 400 psi-WP at 250 deg F with electroless nickel and steel wear surfaces with stainless steel spring, built-in strainer, pressure/temperature ports, and shut-off valve with Teflon packing. Provide complete with polyurethane insulation cover.

- f) Tri-Service Valves – Combination shut-off, throttling and non-slam check valve Series Vic 300 butterfly valve assembled with standard Vic-Check Series 779. Working pressures to 300 psi. Optional Vic-Plug Valve Series 377 assembled with standard Vic-Check. Working pressure to 175 psi. Memory stops standard transition couplings Style 307 required for plug valve assembly.

22-34 PIPE HANGERS AND SUPPORTS:

- a) Provide and be responsible for location of piping hangers, supports, and inserts, etc. required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of MSS SP-58.
- b) Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being inducted into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.
- c) Factory made hangers, attachments and supports to be by Tolco, ZSI, or Anvil and must be installed per manufacturer's requirements. All other hangers, attachments and supports must be approved by A/E prior to installation.
- d) Hangers, strut, clamps and supports located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. If located in a corrosive area, hangers, strut and clamps shall be type 304 (316) stainless steel with stainless steel hardware.
- e) Clamps on all cold and hot water piping shall be fully insulated equal to an Anvil Cush-A-Therm. Cushioned or bare clamps that are not fully insulated are not allowed. Insulation material and thickness shall match specified material.
- f) Where horizontal piping movements are such that hanger rod angularity from vertical is greater than 4 degrees from cold to hot position of pipe, offset hanger, pipe, and structural attachments so that rod is vertical in hot position. Hangers shall not become disengaged by movements of support pipe.
- g) Provide sufficient hangers to adequately support piping system at specified spacing at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustments to maintain pitch required for proper drainage and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.
- h) Hangers in direct contact with copper pipe or tubing shall be copper or plated coated with copper-colored epoxy paint.
- i) Unless indicated otherwise on drawings, support horizontal steel piping as follows:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
0.5" to 0.75"	0.375"	6'
1" to 1.25"	0.375"	8'
1.5"	0.375"	9'
2"	0.375"	10'
2.5" to 3"	0.5"	12'
4" to 5"	0.625"	14'
6"	0.75"	17'
8"	0.875"	19'
10" to 12"	0.875"	21'

- j) Unless indicated otherwise on drawings, support horizontal copper tubing as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	0.375"	6'
1.25" And 1.5"	0.375"	6'
2"	0.375"	9'
2.5"	0.5"	9'
3" and 4"	0.5"	10'

- k) Support horizontal cast iron soil pipe with one hanger for each joint located close to hub.
- l) Support plastic piping as recommended by piping manufacturer.
- m) Provide continuous thread hanger rods wherever possible. No chain, wire, or perforated straps shall be used. Hanger rods shall be subjected to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe-supports indicating pipe sizes, service, and support details to A/E for review prior to fabrication.
- n) Provide Tolco or Anvil pipe hangers for vertical pipe risers per MSS Type 8 or 42:
- Type 8: Tolco Fig. 6 or Anvil Fig. 261.
- Type 42: Tolco Fig. 14 or Anvil Fig 295.
- o) Provide Tolco Fig. 30 steel wall brackets for piping suspended or supported from walls. Brackets shall be carbon steel and selected to meet the load. Finish to be hot dip galvanized in outdoor applications and type 304 (316) stainless steel in corrosive areas.
- p) Where hangers are placed outside the jackets of pipe insulation, provide galvanized metal shields. Minimum 12" Long per MSS-SP-58.
- q) Mount hangers for insulated piping on outside of pipe, hangers sized to allow for full thickness of pipe insulation. Shield shall support lower 180 degrees of pipe insulation. Omit copper plating on hangers mounted outside insulation on copper tubing.

<u>PIPE SIZE</u>	<u>SHIELD LENGTH</u>	<u>MINIMUM GAUGE</u>
0.5" to 1.5"	12"	18
2" to 6"	12"	18
8" to 10"	18"	16
12" to 18"	24"	14
20" & Larger	24"	12

- r) Where roller hangers are required and heat loss must be kept to minimum, use Tolco Fig. 260 – Fig. 265 as required by insulation thickness and pipe size.
- s) Structural attachments for pipe hangers shall be as follows:

1. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18. Tolco Fig. 309 or Anvil Fig. 282.
 2. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19. Tolco Fig. 68 or Anvil Fig. 94.
 3. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 27. Tolco Fig. 336 or Anvil Fig. 14.
 4. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21. Tolco Fig. 62 or Anvil Fig. 133.
 5. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22. Tolco Fig. 305 or Anvil Fig. 66.
 6. For attachment to structural shapes: C-clamps, MSS Type 23. Tolco Fig. 64 or Anvil Fig. 95.
 7. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beam clamps, MSS Type 25. Tolco Fig. 335 or Anvil Fig. 217.
 8. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut for pipe size 12" and smaller MSS Type 28. Tolco Fig. 62 or Anvil Fig. 133. For pipe size 14" and larger MSS Type 29 Tolco Fig. 297SP or Anvil Fig. 292L
 9. Provide Tolco Fig. 506 vibration control hangers at locations on piping to prevent vibrations from being transmitted to building structure by conventional hangers. Apply hangers within their load supporting range and per the following:
 - A. All pipe supports on lines that are connected directly to rotating equipment that have no flexible connection between equipment and piping.
 - B. All pipe supports within the first 50 lineal feet after a flexible connection to rotating equipment. All supports between the flexible connection and the rotating equipment.
 - C. All pipe supports that are attached to piping that is not connected to rotating equipment is exempt from vibration isolation.
- t) Provide Anvil International, Inc. Fig. 45 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

PIPE MATERIAL	PIPE SIZE	CLAMP NO.	ROLLER NO.
Copper	0.375" though 4"	PS1100	PS1901
Steel	0.375" through 6"	PS1100	PS1902

- u) Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Anvil International, Inc. Fig. 259 or equivalent by Advanced Thermal Systems. Where racks and supports are not detailed on drawings, submit detailed support drawings to A/E for review prior to fabrication.
- v) Provide Control Devices HGR Series vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.
- w) Provide TOLCO fig 318A and 316T combination pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.

- x) All piping installed on roofs (except metal roofs) shall be supported by MIRO Industries "Pillow Block Pipe stands." The base of the stand shall be designed to prevent gouging and ripping the roof membrane. The pipe stands shall be designed to absorb shock and thermal expansion and contraction reducing the friction from pipe movement.
- y) Provide Tolco Fig. 20 or Anvil Fig. 262 short strap for attaching pipe tight to ceilings as noted on plans.
- z) Provide necessary structural steel and attachment accessories for installation of pipe hangers and supports. Where heavy piping loads are to be attached to building structure, verify structural loading with A/E prior to installation.
- aa) Equivalent hangers and supports by Tolco, Anvil, PHD, Anvil International, Inc., or Fluorcarbon Company.

22-35 CONCRETE INSERTS AND ANCHORS:

- a) Provide concrete inserts for attaching piping and equipment as follows:
 - 1. In new construction where attachment points can be predetermined, provide PHD Fig. 950 continuous concrete insert of Fig. 950N Universal Steel Concrete insert.
 - 2. In existing construction or new construction where attachment points cannot be located before setting concrete forms, provide McCulloch Kwik-Bolt or Phillips red head concrete anchors of proper type for attachments.
- b) Equals by ITW, Masterset, MKT Fastening, and Power Fastening.

22-36 TESTING PROCEDURES:

- a) Test all lines and systems before they are insulated, painted, or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor, and equipment required for tests.
- b) Where entire system cannot be tested before concealment, test system in sections. Upon completion, each system shall be tested as entire system.
- c) Repair or replace defects, leaks, and materials failures revealed by tests and then retested until satisfactory. Make repairs with new materials.
- d) Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests.
- e) Test methods and pressures shall be as follows:
 - 1. Hydrostatic Test (Closed System):
 - A. Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for systems or 220 percent of operating pressure where not specified.
 - 2. Hydrostatic Test (Open System):
 - A. Test entire system with 10 feet of head water. Where system is tested in sections, each joint in building except uppermost 10 feet of system shall be submitted to at least 10 feet head of head water. Water shall be held in system for 22 minutes before inspection starts. System shall hold test pressure without leaks.
 - 3. Pneumatic Test:

- A. Test entire system with compressed air. Systems operating above 2 psi shall be tested at 75 psi or 220 percent of operating pressure, whichever is greater.
 - B. Allow at least 1 hour after test pressure has been applied before making initial test.
 - C. During test, completely isolate entire system from compressor or other sources of air pressure.
4. Pressure Relief and Safety Valve:
- A. Before installation test pressure temperature and safety relief valves to confirm relief settings comply with Specifications.
 - B. Tag items that pass test with date of test, observed relief pressure setting, and inspector's signature.
 - C. Items installed in systems without test tag attached will be rejected.
- f) All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.
 - g) Upon completion of testing submit five (5) copies of typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time, and all failures with corrective action taken.
 - h) For test pressures see piping material schedule.

22-37 PIPING PROTECTIVE COATING:

- a) Provide pipe lines listed in pipe schedule to be coated with Pipe Line Service Company X-Tru-Coat high density polyethylene or polypropylene coating extruded on pipe over a thermal plastic adhesive.
- b) Coating shall be a minimum of 25 mils thick over minimum 10 mil thickness of thermal plastic adhesive.
- c) Prepare and coat field made pipe joints and make coating repairs according to manufacturer's recommendation. Cover joints with shrinkable polyethylene sleeve. Coated piping passing through pipe sleeve shall have double thickness coating through sleeve.

22-38 PIPING AND EQUIPMENT INSULATION:

- a) Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings. Insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.
- b) Provide insulation materials manufactured by Certain Teed, Knauf, Dow Chemical Company, Johns Manville, or Owen/Corning Fiberglass or Aerocel.
- c) Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as tested by ASTM E 84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

- d) Provided insulation accessories such as adhesives, mastics, cements, tape, and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatments of jackets or facings for impart flame and smoke safety shall be permanent. Use of water-soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

- e) Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips, or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulations sections.
- f) Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.
- g) Where glass is specified in the following insulation methods, provide resin impregnated with open weave glass fabric with 10/20 thread count.
- h) Abbreviations for manufacturers of adhesives, mastics, and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.
- i) Piping insulation materials and application methods by type shall be as follows:
 - 1. TYPE 2-PC: Insulation for cold surface piping system with minus 50 deg F to plus 220 deg F operating temperature range shall be Armstrong AP Armaflex Elastomeric pipe insulation average thermal conductivity shall not exceed 0.27 BTU/Hr. at 75 deg F mean temperature. To greatest extent possible apply insulation without longitudinal joint by slipping insulation over piping. Seal all seams and butt joints with Armstrong 520 adhesive. Thickness shall be per manufacturer's recommendations using a maximum severity of 90 deg F and 80 percent RA. Insulate fittings as follows:
 - A. Insulate exposed and concealed valves fittings with miter-cut pieces of AP/Armaflex pipe insulation equal to thickness of adjoining pipe insulation. Insulate fittings too large to cover with pipe insulation with insulation from fabricated/Armaflex sheet insulation using Armstrong templates. Join and seal all fittings joints with Armstrong 520 adhesive. Finish insulation as soon as possible with two coats of Armstrong Armaflex water-based, latex enamel finish in color selected by Architect. All insulation used outdoors shall be painted to prevent ultra violet deterioration of insulation.
 - 2. TYPE 2-PHC: Insulation for hot and cold surface piping systems with minus 60 deg F to plus 850 deg F operating range shall be Owens-Corning Fiberglas 25 pipe insulation with white fire retardant ASJ jacket. Average 75 deg F mean temperature. Seal longitudinal jacket laps and but strips with C.M. No. 17-465 or B.F. No. 85-75 vapor barrier adhesive. Insulate valves and fittings as follows:
 - A. Insulate exposed and concealed valves and fittings with premolded fitting cover. Vapor seal fittings with heavy brush coat of C.M. No. 16-110 or B.F. No. 30-36 mastic. Lap glass fabric and mastic 2 inches over preceding fabric and 2 inches over adjacent insulation jacket.
- j) Insulation materials and application methods for piping hangers supports, anchors, guides, expansion joints, etc. shall be as follows:
- k) Insulate hangers and supports from direct contact with cold surfaces with ITW Trymer Supercel Phenolic inserts or equal of half or full sections of pre-molded pipe insulation equal in thickness to adjoining insulation. Provide inserts with vapor barrier jacket for lapping 2 inches over adjacent pipe insulation jacket. Protect insulation with insulation shields supporting lower 180 degree of pipe insulation sized so that pipe compressive load does not exceed one-third of insulation insert compressive strength. Seal joints with vapor barrier sealer specified for insulation type used. Materials shall meet the ASTM E84 burn characteristics of 25/50.

1. Insulate pipe anchors in direct contact with cold piping for a distance of 12 inches or as detailed on drawings from contact point with piping. Anchor insulation shall be one-half the thickness of adjoining pipe insulation with vapor barrier. Seal and finish joints with vapor barrier sealer specified for insulation type used.
 2. Insulate pipe guides from direct contact with cold surfaces piping with Styrofoam HD-300 plastic foam full section inserts of pre-molded pipe insulation equal in thickness to adjoining pipe insulation. Provide inserts with vapor barrier jacket for overlapping 2 inches over adjoining pipe insulation. Insert jacket shall be equal in performance and appearance to adjacent insulation jacket. Seal and finish joints with vapor barrier sealer specified for insulation type used.
 3. Where piping hanger cannot be isolated from cold pipe surfaces, insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to a point 12 inches above pipe with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer specified for insulation type used.
 4. Insulate floor supports in direct contact with cold surface piping with Armstrong 0.5-inch-thick Armstrong FR/Armaflex pipe or sheet insulation as required by surface. Insulate supports from pipe to floor plate and seal insulation joints with Armstrong No. 520. Finish insulation with Armstrong Armaflex vinyl-lacquer finish.
 5. All pipe insulation shall be continuous through walls, ceiling, or floor openings or sleeves except where firestop or firesafing materials are required.
- l) Insulation of removable heads and valves, manhole access covers, plumbing pumps, etc. shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.
- m) Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this Specification for a period of one (1) year after date of final acceptance or through one (1) heating season and one (1) cooling season, whichever is longer, shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at M/C's expense at no cost to Owner.

22-39 ELECTRICAL REQUIREMENTS:

- a) Consult Section 26 of electrical Specifications for work to be provided by E/C in conjunction with installation of mechanical equipment.
- b) Electrical work required to install and control mechanical equipment which is not shown on plans or specified under Section 26 shall be included in M/C's base bid proposal.
- c) The cost of larger wiring, conduit, control, and protective devices resulting from installation of equipment which was not used for basis of design as outlined in Section 22-10g of Specifications shall be paid by M/C at no cost to owner or A/E.
- d) M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking, and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.
- e) Furnish six (6) complete sets of electrical wiring diagrams to A/E and three (3) complete sets to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.
- f) M/C shall obtain complete electrical data on mechanical shop drawings and shall list this data on approval form which shall be presented monthly, or on request, to E/C. Data shall be complete with

wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, and locked current to allow E/C to order electrical equipment required in his contract.

- g) Safety-disconnect switches and manual and magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is specified with these devices installed as part of factory built control systems.

22-40 RECORD DOCUMENTS:

- a) Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheers into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.
- b) The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, the following:
 - 1. Piping.
 - 2. Conduits.
- c) The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a disk or CD shall be provided to the Owner as a permanent record.
- d) As-built documents shall be submitted for approval prior to final payment. Copies of "in-progress" as-built drawings shall be submitted at each pay request.

22-41 PIPING SYSTEMS MATERIALS:

- a) Refer to Section 22 of this specification for piping material specifications and installation instructions.
- b) See schedule for specific piping materials and joining methods for systems installed under this section.

22-42 PIPING SYSTEMS VALVES:

- a) Refer to Section 22 of this specification for valve type specifications and installation instructions.
- b) See schedule for valve types to be installed under this section.

Service	Size	Stop	Check	Balance
Domestic Water	Up to 2.5"	BLV-1	--	--
Domestic Water	Up to 2"	--	SCV-1	--
Domestic Water	3" to 8"	BLV-2	--	--
Domestic Water	2.5" & Up	--	SCV-3	--
Domestic Water	Up to 4"	--	--	BAV-1
Natural Gas	Up to 1"	PLV-1/BLV-3	--	--
Natural Gas	1.25" to 2.5"	PLV-2	--	--
Natural Gas	3" to 12"	PLV-3	--	--

22-43 PIPING SYSTEM INSULATION:

- a) Refer to Section 22 for insulation type specifications and installation instructions.
- b) See schedule for insulation types and thickness for piping installed under this section
- c) Per 2012 and 2015 International Codes:

Service	Size	Type	Thickness
Domestic Cold Water	All	2-PC	0.5"
Domestic Hot Water	Up to 1.25"	2-PC	1"
Domestic Hot Water	1.5" & Up	2-PC	1.5"
Domestic Cold Water below Grade	All	2-PC	0.5"
Domestic Hot Water below Grade	Up to 1.25"	2-PC	1"
Domestic Hot Water Return	Up to 1.25"	2-PC	1"
Domestic Hot Water Return	1.5" & Up	2-PC	1.5"
A/C Condensate Drain	Up to 2"	2-PC	0.5"
A/C Condensate Drain	2.5" & Up	2-PC	0.75"

22-44 SCHEDULE OF FIXTURE BRANCHES:

- a) Connection to individual plumbing fixtures shall be as follows:

Item	Waste	Vent	Cold	Hot
Urinal	2"	1.5"	1"	--
Water Closet – Flush Valve	4"	2"	1.25"	--
Water Closet – Flush Tank	4"	2"	0.5"	--
Lavatory	2"	1.25"	0.5"	0.5"
Drinking Fountain	2"	1.25"	0.5"	--
Janitor Basin	3"	1.5"	0.5"	0.5"
Shower	2"	1.5"	0.5"	0.5"
Sink	2"	1.5"	0.5"	0.5"

22-45 ADJUSTMENT AND BALANCING:

- a) Adjust flush valves to minimum volume and balance flow in hot water returns as required to maintain proper water temperature in all branches circulated.

22-46 DRAINS, FLOOR SINKS, DOWNSPOUT NOZZLES, ETC.:

- a) Floor Drains: Block out floor prior to pouring of concrete and then level floor drain after pour is set, remove forms, and grout level. See schedule on drawings.
 - 1. All floor drains in finished areas shall have nickel-bronze strainers except at showers where they shall be chrome-plated strainers.
 - 2. Provide each drain that does not have an integral "P" trap with a cast iron "P" trap in connecting piping.
 - 3. See Architectural plans for floor drain top elevations and floor drainage.
 - 4. Floor drains shall be as manufactured by Wade, Josam, Watts or Zurn.
 - 5. Sioux Chief shall be allowed on PVC piping systems only.
- b) Trap Seal Primers:
 - 1. Provide waterless, inline trap seal protection with UV resistant frame and silicone sealing ribs.

22-47 CLEANOUTS:

- a) Provide cleanouts full size of soil pipe up to and including 4-inch ID. Provide cleanouts at base of stacks, end of sewer main, and at elbows over 45 degrees and in any horizontal run of piping exceeding 100 feet at 50-foot intervals. Block out floor prior to pouring of concrete and then level cleanout after pour is set, remove forms, and grout level. Install cleanouts so they are accessible by extending them through walls, floors, and above or to outside of building, as required. Reference schedule on drawings for cleanout types.
- b) Wall Type Finished Areas: J.R. Smith No. 4532 cast iron cleanout "T" with cleanout plug and stainless steel access cover.
- c) Wall Type Unfinished Areas: J.R. Smith No. 4512 cast iron cleanout "T" with countersunk plug.
- d) Floor Type Hard Flooring Areas: J.R. Smith 4023 with round chrome plated scoriated cover.
- e) Floor Type Carpet Areas: J.R. Smith 4023-X with nickel bronze top and carpet clamp.
- f) Floor Type Carpet Areas: J.R. Smith 4023-Y with nickel bronze top and carpet marker.
- g) Finish Grade Cleanout: J.R. Smith 4223 cast iron with extra duty cast iron top. Install in 18x18x7 concrete pad with #3 rebar and chamfered edges.
- h) Equivalent cleanouts by Wade, Watts, Zurn, Josam or Jonespec will be acceptable.
- i) Verify floor materials used from Architectural plans.

22-48 HYDRANTS AND HOSE BIBBS:

- a) Wall Hydrants: Woodford No. 67 freeze proof with vacuum breaker equivalent by Prier, Wade, Zurn, or J.R. Smith will be acceptable.
- b) Hose Bibbs: Woodford Model 24P-3/4 or equal angle hose bibb with Midel Model 34HF vacuum breaker and loose tee handle.
- c) Freeze Proof Roof Hydrant: MAPA Products Model MPH-24FP pedestal hydrant with stainless steel shroud, roof deck support, built-in vacuum breaker, weather-guard dome handle, and stainless steel reservoir. Units shall be insulated with R-8 thermo-cell insulation.

22-49 SHOCK ABSORBERS:

- a) Provide Josam Absorbotron shock absorbers, or approved equal, on all plumbing fixture batteries where shown on plans sized in accordance with the Plumbing and Drainage Institute Standards PDI WH201. Equivalent shock absorbers by Zurn, Wade, Sioux Chief, or J.R. Smith will be acceptable.

22-50 PLUMBING FIXTURES:

- a) Provide plumbing fixtures as shown on drawings as specified complete including piping and connections. China fixtures shall be of best grade vitreous ware, without pit holes or blemishes, and outlines shall be generally true. Architect reserves right to reject any piece which, in his opinion, is faulty. Fixtures fitting against walls shall have ground backs. Exposed piping and fitting shall be chrome plated.
- b) Set fixtures true and level with all necessary supports for fixtures installed before plastering is done. Nipples through wall to fixture connection shall be chrome plated brass. Contractor may use copper stub outs to stops under lavatories, provided deep escutcheons are used and no copper is visible in lieu of chrome nipples.
- c) Equivalent fixtures and accessories by the following manufacturers will be acceptable:
 - 1. Fixtures: American Standard, Eljer, Kohler, Toto, Crane, or Zurn.
 - 2. Toilet Seats: Church, Olsonite, Toto, Bemis, American Standard, Kohler or Beneke.
 - 3. Fittings, Carriers, and Supports: Josam, J.R. Smith, Zurn, or Wade.
 - 4. Faucets: Sloan, Zurn, Toto, American Standard, Kohler, Delta, Chicago Faucets, or Moen.
 - 5. Flush Valves: Sloan, Zurn, Delany, Toto or American Standard.
 - 6. Traps, Supplies, and Stops: Dearborn, Sanitary Dash, BrassCraft, or as specified under plumbing fixtures:
 - A. Lavatory Supplies and Stops: McGuire LF170, 0.5-inch compression inlet with angle compression stop and 0.375-inch OD risers in length required. Provide deep chrome plated brass escutcheons.
 - B. Water Closet Supplies and Stops: McGuire LF187, 0.5-inch compression inlet with angle compression stop and 0.5-inch OD risers in length required. Provide deep chrome plated brass escutcheons.
 - C. Traps: McGuire 8912C (1.5-inch) and/or 8872C (1.25-inch) cast brass body with cleanout "P" trap. Provide deep chrome plated brass escutcheon with set screw. Provide offset tailpieces as required for ADA compliance.

7. See Schedule for fixture type to be installed under this section.

- d) Refer to architectural plans for exact locations and elevations of all plumbing fixtures. Trip levers on all ADA water closets shall be opposite the grab bar installed beside the water closet.

22-51 WATER HEATER:

- a) Provide water heaters as specified below and as indicated on construction drawings.
- b) Water heaters shall meet ASHRAE 90A-1 980.
- c) Gas water heaters shall be CSA certified.
- d) Electric water heaters shall be UL listed.
- e) Equivalent by National, Lochinvar, Bradford White, Ruud, Rheem, A.O. Smith, or State will be acceptable.

22-52 IN-LINE PUMPS:

- a) Provide in-line pumps with capacities as shown on plans. Pumps shall be in-line type, close-coupled, single-stage design, for installation in vertical or horizontal position, and capable of being serviced without disturbing piping connections.
- b) Pump casing shall be of Class 30 cast iron or as specified. The impeller shall be of cast iron bronze, enclosed type, dynamically balanced, keyed to the shaft, and secure by a locking cap screw. All domestic water pumps shall be low lead/lead free bronze or brass unless otherwise specified.
- c) The liquid cavity shall be sealed off at the motor shaft by an internally flushed mechanical seal with ceramic seal seat and carbon seal ring; suitable for continuous operation at 225 deg F. A bronze shaft sleeve shall completely cover the wetted area under the seal.
- d) Pumps shall be rated for minimum of 175 psi working pressure. The pump case shall have gauge tappings at the suction and discharge nozzles and will include vent and drain ports.
- e) Motor shall meet NEMA specifications and shall be the size, voltage, and enclosure called for on the plans. It shall have heavy-duty grease lubricated ball bearings, completely adequate for the maximum load for which the pump is designed.
- f) Each pump shall be factory tested per Hydraulic Institute Standards. It shall then be thoroughly cleaned and painted with at least one coat of high-grade machinery enamel prior to shipment.
- g) Pumps shall be manufactured by ITT Bell & Gossett, Armstrong, Peerless, Aurora or Taco.

22-53 OPENINGS:

- a) This Contractor shall include the installation of all boxes and sleeves for openings required to install this work, excepting only structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. He shall set and verify the location of sleeves as shown on structural plans that pass through beams, only if so shown.
- b) Penetrations in walls for sheet metal ducts shall be sealed by the M/C by stuffing glass fiber into the cracks between the walls and floors, and the ducts. The exposed joints shall then be caulked on each side with non-hardening caulking such as "Tremco Acoustical Sealant." This work applies to all walls in buildings.

22-54 ACCESS PANELS:

- a) Access panels shall be provided wherever necessary to provide access to valves, traps, etc., located in concealed spaces. Each fire damper, automatic splitter damper, etc., shall have an access panel. Size shall be adequate for inspection and removal of equipment and none shall be less than 12-inch by 6-inch.
- b) Wall and Ceiling Access Doors: Doors shall be equivalent to Milcor DW, concealed frame, access panels. Frame shall be 16-gauge steel with a 14-gauge door panel prime coated with electrostatic powder. Lock shall be a screwdriver operated unless a keyed lock is noted on plans. Equals by Acudor, Babcock-Davis, Cesco, Elmdor, Karp, MiFab and Nystrom.
- c) Fire Rated Wall/Ceiling Access Door: Doors shall be equivalent to Milcor UFR. Frame shall be 16-gauge galvanized bonderized steel and 20-gauge galvanized bonderized steel. Hinges shall be continuous, galvanized steel with stainless steel pin and a key operated latch. Provide automatic type door closure. Door shall have a UL rating to match rating of wall/ceiling rating. Equals by Acudor, Babcock-Davis, Cesco, Elmdor, Karp, MiFab and Nystrom.

22-55 SANITARY SEWER SERVICE:

- a) Contractor shall connect to sanitary sewer connections provided per civil engineering plans
- b) Coordinate with the general contractor that all fees, charges, and costs incurred by the utility are included in the base bid.

22-56 DOMESTIC WATER SERVICE:

- a) Contractor shall connect to water connections provided per civil engineering plans.
- b) Coordinate with the general contractor that all fees, charge, and costs incurred by the utility are included in the base bid.

22-57 NATURAL GAS SERVICE:

- a) Contractor shall arrange for gas service with taps, pit and meter with the local utility. Contractor shall include all fees, costs and charges incurred by the utility in the base bid. Reference civil drawings.

END OF DIVISION 22

DIVISION 23 –HVAC

23-1 CONTRACT DOCUMENTS:

- a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Mechanical Contractor and his subcontractors and material suppliers.

23-2 SPECIFICATION FORM AND DEFINITIONS:

- a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- c) “Provide” means furnish and install.
- d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- e) Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants, 3333 E. Battlefield Suite 1000, Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Tyler Enserro.
- g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.
- i) Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.
- j) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

23-3 GENERAL EXTENT OF WORK:

- a) Provide mechanical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which M/C could have informed himself before bids were taken.
- b) M/C shall familiarize himself with equipment provided by other contractors, which require mechanical connections and controls.

23-4 LOCAL CONDITIONS:

- a) Visit site and determine existing local conditions affecting work in contract.

- b) Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

23-5 CODES, ORDINANCES, RULES, AND REGULATIONS:

- a) Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other Authorities Having lawful Jurisdiction (AHJ).
- b) Conform to latest editions and supplements of the following codes, standards, or recommended practices as adopted by the AHJ.

1. CITY CODES:

- A. 2006 International Plumbing Code.
- B. 2006 International Mechanical Code.
- C. 2006 International Building Code.
- D. 2006 International Fire Code.

2. SAFETY CODES:

- A. National Electric Safety Code Handbook H30 – National Bureau of Standards.
- B. Occupational Safety and Health Standards – Department of Labor.
- C. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.

3. NATIONAL FIRE CODES:

- A. NFPA 54 Gas Appliance and Gas Piping Code.
- B. NFPA 70 National Electric Code – 2005 Edition.
- C. NFPA 89M Clearances, Heat Producing Appliances.
- D. NFPA 90A Air Conditioning and Ventilation Systems.
- E. NFPA 91 Blower and Exhaust Systems.
- F. NFPA 101 Life Safety Code – 2012 Edition.

- c) Where following standards are applicable to equipment specified, equipment shall conform to requirements of standard and shall display the appropriate seal or seals:

- 1. AGA – The American Gas Association Laboratories.
- 2. ASME – American Society of Mechanical Engineers.
- 3. NSF – National Sanitation Foundation.
- 4. UL – Underwriters Laboratories Inc.

- d) Drawings and Specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, Contractor

shall execute work in accordance with such ordinances, laws, codes, rules, or regulations without increased cost to Owner, but not until he has referred such variances to A/E for approval.

- e) M/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules, or regulations. Keep a written record of all permits and inspection certificates and submit two (2) copies to A/E with request for final inspection.

23-6 CONTRACT CHANGE:

- a) Changes or deviations from contract; including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
- b) Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.
- c) All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustment factors. If proposals are not itemized, they will be rejected and returned for proper submittal.
- d) The maximum allowable profit for any change order shall be ten percent (10%).
- e) See Example below:

PRICING SHEET

Project:	Cassville Performance Arts Center	Date:	March 1, 2023
Location:	Cassville, Missouri	Estimator:	Jane Doe
Labor Rate:	\$22.00		

		Unit	Material	Man Hours	Total	Material
Material	Units	Measure	Per Unit	Per Unit	Man Hours	Total
6" tee	1	ea.	\$45.00	2.000	2.0	\$45.00
Less 6" ell	1	ea.	\$30.00	0.000	0.0	\$ 30.00
6" sch 40 pipe	23	ft.	\$10.43	0.253	3.8	\$ 56.46
6" cap	1	ea.	\$11.00	1.500	1.5	\$ 11.00
6" hanger	1	ea.	\$12.00	0.400	0.4	\$ 12.00
4" saddle weld	1	ea.	\$0.00	1.200	1.2	\$ 0.00
4" sch 40	18	ft.	\$4.44	0.183	3.3	\$ 79.92
4" ell	3	ea.	\$13.39	2.000	6.0	\$ 40.17
4" hanger	3	ea.	\$8.00	0.300	0.9	\$ 24.00
4" weld	1	ea.	\$3.00	1.000	1.0	\$ 3.00
1.5" cond sch 80	21	ft.	\$1.63	0.080	1.7	\$ 34.23
1.5" ell	3	ea.	\$4.00	0.400	1.2	\$ 12.00
1.5" tee	1	ea.	\$5.00	0.600	0.6	\$ 5.00
1.5" weld	1	ea.	\$3.00	0.400	0.4	\$ 3.00
0.75" F & T trap	1	ea.	\$73.00	0.500	0.5	\$ 73.00

0.75" strainer	1	ea.	\$12.00	0.500	0.5	\$ 12.00
0.75" XH nipples	4	ea.	\$7.70	0.100	0.4	\$ 30.80
0.75" unions	2	ea.	\$3.18	0.300	0.6	\$ 6.36
0.75" cap	1	ea.	\$0.65	0.100	0.1	\$ 0.65
0.75" pipe sch 80	10	ft.	\$0.72	0.400	0.4	\$ 7.20
0.75" tee	1	ea.	\$1.50	0.300	0.3	\$ 1.50
0.75" ell	3	ea.	\$0.95	0.200	0.6	\$ 2.85
0.75" hanger	2	ea.	\$2.50	0.200	0.4	\$ 5.00
SUBTOTAL					28.74	\$618.47
SALES TAX				6.125%		\$37.88
LABOR	28.4	MH	\$22.00			\$624.80
5% OVERHEAD						\$64.06
8% PROFIT						\$107.62
TOTAL						\$1,452.83

23-7 LOCATIONS AND INTERFERENCES:

- a) Locations of equipment, piping, and other mechanical work are indicated diagrammatically by mechanical drawings. Determine exact locations on job, subject to structural conditions, work of other contractors, access requirements for installation and maintenance, and to approval of A/E.
- b) Study and become familiar with contract drawings of other trades and in particular the general construction plans and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.
- c) Any pipe, apparatus, appliance, or other item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the Contractor, his subcontractor, or his workmen shall be restored as specified for new work.
- d) Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

23-8 SYSTEM PERFORMANCE:

- a) Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment and all required programming installed under this Specification.
- b) Contractor shall be responsible for all work as required by phasing of construction for intended use by the owner as applicable.

23-9 WARRANTY:

- a) M/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this Specification Division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.
- b) Where manufacturers' warranties expire during the one (1) year warranty period, one (1) year warranty period is defined as year after date of substantial completion. M/C shall include provisions for extending warranty for the full one (1) year period and shall cost for warranty extension in his base bid.
- c) M/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at M/C's expense.
- d) The above warranty shall not supersede any separately stated warranty or other requirements by law or by these Specifications.
- e) If the Architect's specification includes a warranty that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

23-10 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS:

- a) The intent of these Specifications is to allow ample opportunity for M/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.
- b) Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.
- c) In general, these Specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and Specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product they may propose to furnish as equivalent to the first named product unless specific model or catalog numbers are listed in these Specifications or in subsequent addenda. Where other than first named products are used for M/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, that will meet or exceed the Specifications and are acceptable to the D/E.
- d) Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- e) **PRIOR TO RECEIPT OF BIDS, IF M/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.**
- f) Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name,

model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.

- g) In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including adjustments in mechanical/electrical service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.
- h) Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, M/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, M/C shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.
- i) After execution of contract, substitution of product brands for those named in Specifications will be considered, only if; 1) request is received within 30 days after contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or 2) Owner requests consideration be given to substitute brands.

23-11 SHOP DRAWINGS, OPERATION, AND MAINTENANCE INSTRUCTION:

- a) Unless noted differently in the general requirements of the specifications, M/C shall furnish a minimum of six (6) sets of shop drawings of all materials and equipment, Engineer will retain one (1) set.
- b) Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc. that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these Specifications, or plan sheet number, when item does not appear in Specifications. Where equipment submitted does not appear in base Specifications of specified equivalent, mark submittals with applicable alternate numbers, change order numbers, or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- c) M/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear M/C approval stamp which shall indicate that M/C has reviewed submittals and that they meet Specification and/or drawing requirements. M/C's submittal review shall specifically check for, but not limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting M/C's approval shall be returned to his supplier for resubmittal.
- d) No shop drawing submittals will be considered for review by the A/E without M/C's approval stamp, or that have extensive changes made on the original submittal as a result of Contractor's review. All comments or minor notations on shop drawings shall be flagged as follows to indicate originator of comment or notation: 1 Contractor, 2 Construction Manager, 3 Architect, and 4 Engineer.
- e) A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without M/C's review and approval stamp. A letter will be sent to M/C by either the Architect or Engineer indicating receipt of an improper submittal. M/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by M/C or supplier for 23 working days after date of receipt. If not picked up by the 26th working day, submittals will be disposed of by A/E.
- f) A/E's review of shop drawings will not relieve M/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing to Owner or his

representative, nor shall it relieve M/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be M/C's responsibility.

g) Operating and Maintenance Instructions:

1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.
2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.
3. Contractor shall provide all final documents including drawings, shop drawings, etc. in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this Specification, will also be required at closeout.

23-12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS:

- a) Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.
- b) Where the contractor proposes to use different equipment that results in significant difference in routing or space considerations than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

23-13 CAD/BIM FILE REQUESTS:

- a) CAD files and/or BIM models (only where created as part of the project design) are the property of the D/E and are only available upon documented written request. Prior to receiving any CAD files or models, the contractor shall submit a drawing cost fee of \$50/drawing up to a maximum \$1500 (BIM MEP models are \$500). In addition, the contractor must sign a Third Party User Agreement and Drawing Request Form which must be forwarded to the D/E office prior to any CAD files being released. This form is available from the D/E upon request.

23-14 CUTTING AND PATCHING:

- a) M/C shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- b) Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- c) Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete-hole-saw or concrete drill. Do not use star drill or air hammer for this work.

23-15 MUTILATION:

- a) Mutilation of building finishes, caused by installation of mechanical equipment, fixtures, piping, and other mechanical devices shall be repaired at M/C's expense to approval of Architect.

23-16 EXCAVATION AND BACKFILL:

- a) Perform necessary excavating to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc. as required and remove same at completion of work. Perform excavation in accordance with appropriate section of these Specifications, and in compliance with OSHA Safety Standards.
- b) Excavate trenches of sufficient width to allow ample working space, and a minimum of 6", and no deeper than necessary, for installation work.
- c) Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footings with selected earth or sand and tamp to compaction required by A/E. Mechanically tamp backfill under concrete and paving in 6-inch layers to 95 percent standard density.
- d) Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moisten as required for specified compaction density. Dispose of excess earth, rubble, and debris as directed by Architect.
- e) When available, refer to test-hole information on Architectural drawings or specifications for types of soil to be encountered in excavation in base bid.
- f) Trenches shall be installed to have a bedding of natural or artificial graded fixture of crushed gravel or sand with 100% passing a 1 inch sieve and not more than 8% passing a #200 sieve. All depressions shall be filled with tamped and sand backfill. Place and compact backfill of sub-base material free of particles larger than 1" over piping. Compact each 6" layer at 85% density. Install warning tape directly above piping outside the building at 12" below grade.
- g) Gravel for use of backfill will not be accepted unless approved by Engineer.
- h) Notify Engineer two (2) business days prior to plumbing inspection by AHJ so that Engineer can visually inspect piping prior to backfill.

23-17 SETTING, ADJUSTMENT, AND EQUIPMENT SUPPORTS:

- a) Work shall include mounting, alignment, and adjustment of systems and equipment.
- b) Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown, specified, or required by E/M's installation instructions.
- c) Provide concrete bases for all floor and slab mounted equipment. Refer to drawings for required base type and size. Provide 3.5-inch high base where base is not shown on drawings.

23-18 START-UP, CHANGE-OVER, TRAINING, AND OPERATIONAL CHECKS:

- a) M/C shall perform initial start-up of systems and equipment and shall provide necessary supervision and labor to make first seasonal changeover of systems. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.

23-19 PAINTING OF MATERIALS AND EQUIPMENT:

- a) Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of

one (1) primer and two (2) finish coats with total thickness of at least 5 mils. Finish coat colors in finish areas shall be as selected by A/E.

- b) After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
- c) Where extensive refinishing of factory applied finishes are required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.
- d) Paint all exterior natural gas piping with one (1) primer coat and two (2) finish coats.

23-20 MAINTENANCE OF SYSTEMS:

- a) M/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract.

23-21 FILTERS:

- a) Provide temporary throw-away filters in all permanent heating and air conditioning equipment systems being utilized during construction. Prior to testing and balancing systems, remove temporary filter media and install clean unused filters of the type specified. Clean filters shall be installed in equipment for final acceptance inspection by A/E.
- b) Unless shown or specified otherwise 2" AP-Thirteen, MERV 11 minimum filter efficiency in all rooftop and air handling units. All units 2,000 cfm and greater shall be provided with MERV 8 pre-filters and MERV-13 final filters.
- c) All filter frames for air handling, dedicated outdoor air, make-up air and energy recovery units shall be synthetic. Cardboard frames are not acceptable. All filters shall be accessible through hinged access door with clamp – screw or other mechanical removal is not acceptable.
- d) Unless shown or specified otherwise, provide Farr filters. MERV 8 minimum filter efficiency in all fan coil units, VRF units and fan terminal units.

23-22 CLEANING OF HVAC SYSTEM AND EQUIPMENT:

- a) After pressure testing of systems and equipment and before operational test, thoroughly clean interiors of ductwork and equipment.
- b) Clean equipment as recommended by manufacturers. Where specific instructions are not provided by equipment manufacturer, clean equipment systems as follows:
 - 1. Air Handling System: Before starting any air system, clean all debris, foreign matter, and construction dirt from air system and fan. Provide equipment requiring filters, such as air handling units, fan coil units, blowers, etc. with throwaway filters specified under this Specification. After cleaning air system, install temporary filters and run continuously for eight (8) hours at full volume. Replace temporary filters with final filters immediately prior to testing and balancing.

23-23 PIPING IDENTIFICATION:

- a) Identify piping in mechanical rooms, above ceilings, open pipe chases, tunnels and other places where piping is accessible for operation and maintenance by painting with identification colors and with pressure sensitive pipe markers.
- b) Place piping markers so they can be easily read from operating position and floor.

- c) Mark piping with marker and a 3-inch-wide band of identification color around circumference of pipe in lieu of painting complete pipe or pipe covering.
- d) Lettering on marker shall be at least 1-inch-high block type in contrasting color. An arrow indicating flow direction shall be painted next to each marker. Where markers occur on parallel groups of piping, they shall be neatly lined up.
- e) See Schedule.

PIPING IDENTIFICATION SCHEDULE

Service	Letter Wording	Marker Color	Letter Color
A/C Condensate Drain	Drain	Green	White

23-24 WELDING:

- a) Contractor shall be responsible for quality of welding and suitability of welding procedures. All welding shall be in accordance with American Welding Society AWS B3.0 and ANSI Z49.1.
- b) Welding shall be done only by welders who have successfully passed welder qualification tests in previous 12 months for type of welding required. Each welder shall identify his work with a code marking before starting any welded pipe fabrication. Contractor shall submit three (3) copies of a list of welders who will work on project listing welder's code, date, and types of latest qualification tests passed by each welder.
- c) Welded joints shall be fusion welded in accordance with Level AR3 of AWS D10.9 "Standard for Qualification of Welding Procedures and Welders for Pipe and Tubing." Welders qualified under National Certified Pipe Welding Bureau will be acceptable.
- d) Bevel all piping and fittings in accordance with recognized standards by flame cutting or mechanical means. Align and position parts so that branches and fittings are set true. Make changes in direction of piping systems with factory made welding fittings. Make branch connections with welding tees or forged weldolets.

23-25 PIPING MATERIALS AND FITTINGS:

- a) Piping used throughout project shall conform to the following specifications. Piping shall be plainly marked with manufacturer's name and weight. All materials listed may not be required on this project. See piping material schedules, on drawings, for materials to be used for each piping system. Piping materials shall be as follows:
 - 1. Polyvinyl Chloride (PVC) Pipe:
 - A. Provide Type 1, Grade 1 PVC pipe conforming to requirements of current ASTM D 1785 for pressure piping as scheduled. Pipe shall be approved by NSF for potable water.
 - B. Piping for pressure piping shall have plain ends for socket type fittings.
 - C. Pipe by Chemtrol, Charlotte, Tyler, Pipelife, Cabot, or equal.
 - 2. Copper Tube:

- A. Provide hard temper copper water tube conforming to requirements of current ASTM B 88. Tubing shall be Type K, L, or M as listed in schedule.
 - B. Tubing joints shall be soldered or brazed. See schedule for joining method to be used.
 - C. Pipe by Cerro, Chase, Mueller, Revere Copper, or equal.
3. Chlorinated Polyvinyl Chloride (CPVC) Pipe:
- A. 2" and smaller to be Copper Tube Size (CTS) CPVC pipe and fittings – Conforming to ASTM D2846, FlowGuard Gold CPVC compound material and shall meet a cell class rating of 24448 as defined by ASTM D1784, and shall be certified/labeled by NSF International for use in potable water systems.
 - B. FlowGuard Gold material shall meet the flame spread / smoke developed rating of 25/50 as tested in accordance with ASTM E 84, and shall be tested empty and have third party test data available confirming material meets the 25/50 requirement.
 - C. Pipe by Charlotte, Cresline, Genova, GF Harvel, Bow, IPEX and Nibco
4. Copper Tube Type ACR:
- A. Provide hard or annealed temper nitrogenized copper refrigerant tube conforming to requirements of current ASTM B 280. Tubing 2" and larger shall be hard temper.
 - B. Tubing joints shall be brazed or grooved joints shall be manufactured to copper-tube dimensions. (Flaring tube endings to accommodate alternate sized couplings is not allowed.)
 - C. Pipe by Cerro, Mueller, or equal.

23-26 PIPE FITTINGS:

- a) Pipe fittings used throughout project shall be proper type for installation method used and shall be compatible with piping system materials. Fittings listed in piping material schedule shall conform to the following specifications:
 - 1. Wrought Copper Fittings:
 - A. Provide wrought solder joint copper tube fitting conforming to ANSI B16.22.
 - B. Fittings by Chase, Nibco, or equal.

23-27 INSULATING UNIONS AND FLANGES:

- a) Provide insulating unions and flanges conforming to following specifications and plainly and permanently marked with manufacturer's name and pressure class rating. Unions and flanges shall be as follows:
 - 1. Steel pipe to steel pipe screwed end:
 - A. Provide Stockham malleable iron No. 693-0.5 insulating union with high dielectric strength insulating sleeve and gasket.
 - 2. Steel pipe to steel pipe flanged end:

- A. Provide two (2) weld neck flanges of proper pressure rating insulated on both sides with Central or Klingerit Flange Insulation Kit.
- 3. Iron or steel pipe to copper pipe:
 - A. Provide Epco dielectric union or flange with screwed or solder joint as required. Union shall have 250 psi rating and flange 175 psi rating at 190 deg F. Equal by Capitol Manufacturing, Central Plastics and Watts Regulator.
 - B. Dielectric nipples shall not be used.

23-28 UNIONS:

- a) Provide unions or flanged joint in each line preceding connections to equipment or valves requiring maintenance.
- b) Provide Stockham brass seat unions of material and pressure rating required by piping system.
- c) Where piping systems of dissimilar materials are jointed together, provide proper insulating union as specified under this Specification.

23-29 PIPING INSTALLATION:

- a) Piping systems materials and installation shall conform to the following standards and codes:
 - 1. System: Heating and Air Conditioning Piping Code: ANSI Standard B31.9 "Power Piping"
- b) Pipe sizes indicated on plans and as specified refer to nominal size in inches for steel pipe, cast iron pipe, and copper tubing unless otherwise indicated. Pipes are sized to nearest half-inch. In no case shall piping smaller than size specified be used.
- c) Contractor shall provide and be responsible for proper location of pipe sleeves, hangers, supports, and inserts. Install hangers, supports, inserts, etc. as recommended by manufacturer and as specified and detailed on drawings. Verify construction types and provide proper hangers, inserts, and supports in accordance with manufacturer's load ratings and provide for thermal expansion of piping without exceeding allowable stress on piping or supports. Provide solid type hangers and supports where pipe travel exceeds manufacturer's recommendations for fixed hanger and supports. Provide copper plated hangers and supports for suspension of un-insulated copper tubing lines.
- d) Provide escutcheon plates on all piping penetrations of exposed walls. Paint to match exposed surface.
- e) Install all piping parallel with building lines and parallel with other piping to obtain a neat and orderly appearance of piping systems. All piping shall be concealed unless noted otherwise. Secure piping with approved anchors and provide guides where required to insure proper direction of piping expansion. Piping shall be installed so that allowable stress for piping, valves, and fittings used are not exceeded during normal operation or testing of piping system.
- f) Provide piping materials and wall thickness for specific piping systems as listed in piping schedules in Section 23. Steel piping systems 2.5 inches and under shall be threaded pipe fittings. Steel pipe systems 3 inches and above shall be welded end pipe and fittings unless required otherwise by Code.
- g) Where listed in piping schedules or noted on drawings, provide 2 inches and larger with Victaulic grooved couplings as specified.
- h) Provide unions or flanged joints in each pipe line preceding connections to equipment to allow removal for repair or replacement. Provide all screwed end valves with union adjacent to valve unless valve can

be otherwise easily removed from line. Provide unions on identical sizes of equipment for which one replacement item to be installed between unions without making any piping changes.

- i) Piping fitting materials for specific piping systems shall be as listed in piping schedule. Fittings shall be approved factory made type with threaded or weld ends as required. Fitting pressures and temperature ratings shall be equal to or exceed maximum operating temperature and working pressure of piping system. No mitered or field fabricated pipe fittings will be permitted.
- j) All pipe threads shall meet ANSI B2.1 for taper threads. Lubricate pipe threads with Astroseal Teflon thread sealant and lubricating compound applied full strength. Powdered or made up compound will not be permitted. Pipe thread compound shall be applied only to male pipe threads.
- k) Welded pipe joints shall be made by qualified welding procedures and welders. Welding electrodes shall be type and material recommended by electrode manufacturer for materials to be welded. All pipe fitting ends shall be beveled a minimum of 30 degrees prior to welding.
- l) Brazed socket type joints shall be made with suitable brazing alloys. Minimum socket depth shall be sufficient for intended service. Brazing alloy shall be end fed into socket and shall fill completely annular clearance between socket and pipe or tube. Brazed joints depending solely upon a fillet rather than a socket type joint will not be acceptable.
- m) Soft soldered socket type joints shall be made with 95-5 tin-antimony solder as required by temperature and pressure rating of piping systems. Solder socket joints shall be limited to systems containing nonflammable and non-toxic fluids. Soldered socket-type joints shall not be used on piping systems subject to shock or vibration. Soldered joints depending solely upon a fillet rather than a socket-type joint will not be acceptable.
- n) Make changes in piping size and direction with approved factory made fittings. Steel pipe and fittings suitable for at least 125 psi working pressure or of pressure rating required for maximum working pressure of system, whichever is greater.

23-30 VALVES AND INSTALLATION:

- a) Install necessary valves within piping systems to provide required flow control and to allow isolation for inspection, maintenance, and repair of each piece of equipment or fixture, and on each main and branch service loop. For application of specific valve types see Section 23 of this Specification.
- b) Valves 2.5 inches and smaller have solder, socket weld, flanged, or screwed end connections as required by piping materials unless otherwise specified or shown on drawings. Install union connection in the line within 2 feet of each screw end valve unless valve can be otherwise easily removed from line. Valves 3 inches and over shall have flange end connections or butt weld ends as scheduled. Optional Victaulic grooved valves may be used where scheduled.
- c) Each valve shall be installed so that it is easily accessible for operation, visual inspection, and maintenance.
- d) Non-rising stem valves shall not be installed at any point in the piping systems. With permission of A/E, non-rising stem valves may be installed at particular points where space is restricted.
- e) Valves installed in piping systems shall be compatible with system maximum test pressure, pipe materials, pipe joining method, and fluid or gas conveyed in system.
- f) Valves shall be the same size as piping shown on drawings. Do not reduce valve size.

23-31 VALVES:

- a) Ball valves shall be scheduled as Type "BLV" valves. Valve specifications by type number shall be as follows:

TYPE NO	SPECIFICATION
BLV-1	2.5-inch valves and smaller: Apollo Series 77C-X40, bronze (MSS SP-110) full port ball valve 600 psi-WOB, Teflon seats, 316 stainless steel ball and stem with insulated handle and soldered, grooved or screwed ends. Provide stem extension for handle as required for insulation of valve body.

23-32 PIPE HANGERS AND SUPPORTS:

- a) Provide and be responsible for location of piping hangers, supports, and inserts, etc. required for installation of piping under this contract. Design of hangers and supports shall conform to current issue of MSS SP-58.
- b) Pipe hangers shall be capable of supporting piping in all conditions of operation. They shall allow free expansion and contraction of piping, and prevent excessive stress resulting from transferred weight being inducted into pipe or connected equipment. Support horizontal or vertical pipes at locations of least vertical movement.
- c) Factory made hangers, attachments and supports to be by Tolco, ZSI, or Anvil and must be installed per manufacturer's requirements. All other hangers, attachments and supports must be approved by A/E prior to installation.
- d) Hangers, strut, clamps and supports located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. If located in a corrosive area, hangers, strut, and clamps shall be type 304 (326) stainless steel with stainless steel hardware.
- e) Provide sufficient hangers to adequately support piping system at specified spacing at changes in piping direction and at concentrated loads. Hangers shall provide for vertical adjustments to maintain pitch required for proper drainage and for longitudinal travel due to expansion and contraction of piping. Fasten hangers to building structural members wherever practicable.
- f) Hangers in direct contact with copper pipe or tubing shall be copper or plated coated with copper-colored epoxy paint.
- g) Unless indicated otherwise on drawings, support horizontal steel piping as follows:

PIPE SIZE	ROD DIAMETER	MAXIMUM SPACING
0.5" to 0.75"	0.375"	6'
1" to 1.25"	0.375"	8'
1.5"	0.375"	9'
2"	0.375"	10'
2.5" to 3"	0.5"	12'
4" to 5"	0.625"	14'
6"	0.75"	17'
8"	0.875"	19'
10" to 12"	0.875"	21'

h) Unless indicated otherwise on drawings, support horizontal copper tubing as follows:

NOM. TUBING SIZE	ROD DIAMETER	MAXIMUM SPACING
Up to 1"	0.375"	6'
1.25" And 1.5"	0.375"	6'
2"	0.375"	9'
2.5"	0.5"	9'
3" and 4"	0.5"	10'

i) Support plastic piping as recommended by piping manufacturer.

j) Provide continuous thread hanger rods wherever possible. No chain, wire, or perforated straps shall be used. Hanger rods shall be subjected to tensile loading only, where lateral or axial pipe movement occurs provide suitable linkage to permit swing. Provide pipe support channels with galvanized finish for concealed locations and painted finish for exposed locations. Submit design for multiple pipe-supports indicating pipe sizes, service, and support details to A/E for review prior to fabrication.

k) Provide Tolco or Anvil pipe hangers for vertical pipe risers per MSS Type 8 or 42:

Type 8: Tolco Fig. 6 or Anvil Fig. 261.

Type 42: Tolco Fig. 14 or Anvil Fig 295.

l) Provide Tolco Fig. 30 steel wall brackets for piping suspended or supported from walls. Brackets shall be carbon steel and selected to meet the load. Finish to be hot dip galvanized in outdoor applications and type 304 (326) stainless steel in corrosive areas.

m) Where hangers are placed outside the jackets of pipe insulation, provide galvanized metal shields. Minimum 12" Long per MSS-SP-58.

n) Mount hangers for insulated piping on outside of pipe, hangers sized to allow for full thickness of pipe insulation. Shield shall support lower 180 degrees of pipe insulation. Omit copper plating on hangers mounted outside insulation on copper tubing.

PIPE SIZE	SHIELD LENGTH	MINIMUM GAUGE
1/2" to 1-1/2"	12"	18
2" to 6"	12"	18
8" to 10"	18"	26
12" to 18"	24"	14
20" & Larger	24"	12

o) Where roller hangers are required and heat loss must be kept to minimum, use Tolco Fig. 260 – Fig. 265 as required by insulation thickness and pipe size.

p) Structural attachments for pipe hangers shall be as follows:

1. For upper attachment for suspending pipe hangers from concrete: Concrete inserts MSS Type 18. Tolco Fig. 309 or Anvil Fig. 282

2. For attachment to top flange of structural shape: Top beam C-clamps, MSS Type 19. Tolco Fig. 68 or Anvil Fig. 94
3. For attachment to bottom flange of structural shape: Side beam or channel clamps, MSS Type 27. Tolco Fig. 336 or Anvil Fig. 14.
4. For attachment to center of bottom flange of beams: Center beam clamps, MSS Type 21. Tolco Fig. 62 or Anvil Fig. 133.
5. For attachment to bottom of beams where heavy loads are encountered and hanger rod sizes are large: Welded attachments, MSS Type 22. Tolco Fig. 305 or Anvil Fig. 66.
6. For attachment to structural shapes: C-clamps, MSS Type 23. Tolco Fig. 64 or Anvil Fig. 95.
7. For attachment to top of beams when hanger rod is required tangent to edge of flange: Top I-beam clamps, MSS Type 25. Tolco Fig. 335 or Anvil Fig. 217.
8. For attachment to bottom of steel I-beams for heavy loads: Steel I-beam/WF-beam clamps with eye nut for pipe size 12" and smaller MSS Type 28. Tolco Fig. 62 or Anvil Fig. 133. For pipe size 14" and larger MSS Type 29 Tolco Fig. 297SP or Anvil Fig. 292L
 - A. Provide Tolco Fig. 506 vibration control hangers at locations on piping to prevent vibrations from being transmitted to building structure by conventional hangers. Apply hangers within their load supporting range and per the following:
 - B. All pipe supports on lines that are connected directly to rotating equipment that have no flexible connection between equipment and piping.
 - C. All pipe supports within the first 50 lineal feet after a flexible connection to rotating equipment. All supports between the flexible connection and the rotating equipment.
 - D. All pipe supports that are attached to piping that is not connected to rotating equipment is exempt from vibration isolation.

q) Provide Anvil International, Inc. Fig. 45 channel trapeze pipe hangers for horizontal multiple pipe runs with pipe clamps or pipe rollers as follows:

PIPE MATERIAL	PIPE SIZE	CLAMP NO.	ROLLER NO.
Copper	0.375" though 4"	PS1100	PS1901
Steel	0.375" through 6"	PS1100	PS1902

- r) Pipe supports for horizontal piping mounted on pipe racks or stanchions shall be Anvil International, Inc. Fig. 259 or equivalent by Advanced Thermal Systems. Where racks and supports are not detailed on drawings, submit detailed support drawings to A/E for review prior to fabrication.
- s) Provide Control Devices HGR Series vibration control hangers at locations where piping vibrations would be transmitted to building structure by conventional hangers. Apply hangers within their load supporting range.
- t) Provide TOLCO fig 318A and 326T combination pipe saddle with adjuster to support piping from floor. Provide complete with pedestal type floor stand.
- u) All piping installed on roofs (except metal roofs) shall be supported by MIRO Industries "Pillow Block Pipe stands." The base of the stand shall be designed to prevent gouging and ripping the roof

membrane. The pipe stands shall be designed to absorb shock and thermal expansion and contraction reducing the friction from pipe movement.

- v) Provide Tolco Fig. 20 or Anvil Fig. 262 short strap for attaching pipe tight to ceilings as noted on plans.
- w) Provide necessary structural steel and attachment accessories for installation of pipe hangers and supports. Where heavy piping loads are to be attached to building structure, verify structural loading with A/E prior to installation.
- x) Equivalent hangers and supports by Tolco, Anvil, PHD, Anvil International, Inc., or Fluorcarbon Company.

23-33 CONCRETE INSERTS AND ANCHORS:

- a) Provide concrete inserts for attaching piping and equipment as follows:
 - 1. In new construction where attachment points can be predetermined, provide PHD Fig. 950 continuous concrete insert of Fig. 950N Universal Steel Concrete insert.
 - 2. In existing construction or new construction where attachment points cannot be located before setting concrete forms, provide McCulloch Kwik-Bolt or Phillips red head concrete anchors of proper type for attachments.
- b) Equals by ITW, Masterset, MKT Fastening, and Power Fastening.

23-34 TESTING PROCEDURES:

- a) Test all lines and systems before they are insulated, painted, or concealed by construction or backfilling. Provide fuel, water, electricity, materials, labor, and equipment required for tests.
- b) Where entire system cannot be tested before concealment, test system in sections. Upon completion, each system shall be tested as entire system.
- c) Repair or replace defects, leaks, and materials failures revealed by tests and then retested until satisfactory. Make repairs with new materials.
- d) Verify that system components are rated for maximum test pressures to be applied. Where specified test pressures exceed component ratings, remove or isolate components from system during tests.
- e) Test methods and pressures shall be as follows:
 - 1. Hydrostatic Test (Closed System):
 - A. Hydrostatic test shall be performed using clean unused domestic water. Test pressures shall be as scheduled for systems or 230 percent of operating pressure where not specified.
 - 2. Hydrostatic Test (Open System):
 - A. Test entire system with 10 feet of head water. Where system is tested in sections, each joint in building except uppermost 10 feet of system shall be submitted to at least 10 feet head of head water. Water shall be held in system for 23 minutes before inspection starts. System shall hold test pressure without leaks.
 - 3. Pneumatic Test:
 - A. Test entire system with compressed air. Systems operating above 2 psi shall be tested at 75 psi or 230 percent of operating pressure, whichever is greater.

- B. Allow at least 1 hour after test pressure has been applied before making initial test.
 - C. During test, completely isolate entire system from compressor or other sources of air pressure.
4. Refrigerant Piping:
- A. Test piping by pneumatic test using carbon dioxide or dry nitrogen. Test high and low side of refrigerant system for minimum leakage as specified in ANSI B9.1 for refrigerant used.
 - B. System shall successfully hold test pressure for 24 hours without pressure drop. Following pressure test, evacuate entire system to an absolute pressure of 5,000 microns at ambient temperature of not less than 55 deg F. System shall hold vacuum for two (2) hours with absolute pressure increase of not more than 25 microns.
 - C. Following successful completion of vacuum test, immediately charge system with refrigerant.
5. Pressure Relief and Safety Valve:
- A. Before installation test pressure temperature and safety relief valves to confirm relief settings comply with Specifications.
 - B. Tag items that pass test with date of test, observed relief pressure setting, and inspector's signature.
 - C. Items installed in systems without test tag attached will be rejected.
- f) All systems shall hold scheduled test pressures for specified time without loss of initial test pressure.
 - g) Upon completion of testing submit five (5) copies of typewritten report to A/E. Report shall list systems tested, test methods, test pressures, holding time, and all failures with corrective action taken.
 - h) For test pressures see piping material schedule.

23-35 PIPING AND EQUIPMENT INSULATION:

- a) Provide necessary materials and accessories for installation of insulation for plumbing and mechanical systems as specified and/or detailed on drawings. Insulation type, jacket, and thickness for specific piping systems or equipment shall be as listed in insulation schedule.
- b) Provide insulation materials manufactured by Certain Teed, Knauf, Dow Chemical Company, Johns Manville, or Owen/Corning Fiberglas.
- c) Insulation, except where specified otherwise, shall have composite fire and smoke hazard ratings as tested by ASTM E 84, NFPA 255, and UL 723 procedures not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

- d) Provided insulation accessories such as adhesives, mastics, cements, tape, and glass fabric with same component ratings as listed above. Products or their shipping cartons shall bear label indicating their flame and smoke ratings. Treatments of jackets or facings for impart flame and smoke safety shall be permanent. Use of water soluble treatments such as corn paste or wheat paste is prohibited. This does not exclude approved lagging adhesives.

- e) Install insulation over clean dry surfaces with joints firmly butted together. Insulation at equipment, flanges, fittings, etc. shall have straight edges with box type joints with corner beads as required. Where plumbing and heating insulation terminates at equipment or unions, taper insulation at 30 degree angle to pipe with one coat finishing cement and finish same as fittings. Total insulation system shall have neat smooth appearance with no wrinkles, or folds in jackets, joint strips, or fitting covers. Seal butt joints at maximum intervals of 45 feet to prevent vapor barrier failures from being transmitted to adjoining insulations sections.
- f) Undamaged insulation systems on cold surface piping and equipment shall perform their intended functions as vapor barriers and thermal insulation without premature deterioration or vapor barrier. Contractor shall take every reasonable precaution to provide insulation systems with continuous unbroken vapor barriers.
- g) Where glass is specified in the following insulation methods, provide resin impregnated with open weave glass fabric with 10/20 thread count.
- h) Abbreviations for manufacturers of adhesives, mastics, and coating specified shall be C.M. for Chicago Mastic Company and B.F. for Benjamin Foster Company.
- i) Piping insulation materials and application methods by type shall be as follows:
 - 1. TYPE 2-PC: Insulation for cold surface piping system with minus 50 deg F to plus 220 deg F operating temperature range shall be Armstrong AP Armaflex Elastomeric pipe insulation average thermal conductivity shall not exceed 0.27 BTU/Hr. at 75 deg F mean temperature. To greatest extent possible apply insulation without longitudinal joint by slipping insulation over piping. Seal all seams and butt joints with Armstrong 520 adhesive. Thickness shall be per manufacturer's recommendations using a maximum severity of 90 deg F and 80 percent RA. Insulate fittings as follows:
 - A. Insulate fittings with miter-cut pieces of AP/Armaflex pipe insulation equal to thickness of adjoining pipe insulation. Insulate fittings too large to cover with pipe insulation with insulation from fabricated/Armaflex sheet insulation using Armstrong templates. Join and seal all fittings joints with Armstrong 520 adhesive. Finish insulation as soon as possible with two coats of Armstrong Armaflex water-based, latex enamel finish in color selected by Architect. All insulation used outdoors shall be painted to prevent ultra violet deterioration of insulation.
- j) Insulation materials and application methods for piping hangers supports, anchors, guides, expansion joints, etc. shall be as follows:
 - 1. Insulate hangers and supports from direct contact with cold surfaces with ITW Trymer Supercel Phenolic inserts or equal of half or full sections of pre-molded pipe insulation equal in thickness to adjoining insulation. Provide inserts with vapor barrier jacket for lapping 2 inches over adjacent pipe insulation jacket. Protect insulation with insulation shields supporting lower 180 degree of pipe insulation sized so that pipe compressive load does not exceed one-third of insulation insert compressive strength. Seal joints with vapor barrier sealer specified for insulation type used. Materials shall meet the ASTM E84 burn characteristics of 25/50.
 - 2. Insulate pipe anchors in direct contact with cold piping for a distance of 12 inches or as detailed on drawings from contact point with piping. Anchor insulation shall be one-half the thickness of adjoining pipe insulation with vapor barrier. Seal and finish joints with vapor barrier sealer specified for insulation type used.
 - 3. Insulate pipe guides from direct contact with cold surfaces piping with Styrofoam HD-300 plastic foam full section inserts of pre-molded pipe insulation equal in thickness to adjoining pipe insulation. Provide inserts with vapor barrier jacket for overlapping 2 inches over adjoining pipe insulation. Insert jacket shall be equal in performance and appearance to adjacent insulation jacket. Seal and finish joints with vapor barrier sealer specified for insulation type used.

4. Where piping hanger cannot be isolated from cold pipe surfaces, insulate piping at hanger locations with extra thickness of pipe insulation. Insulate hanger rod to a point 12 inches above pipe with minimum insulation thickness equal to one-half thickness of pipe insulation. Seal and finish joints with vapor barrier sealer specified for insulation type used.
 5. Insulate floor supports in direct contact with cold surface piping with Armstrong 0.5-inch-thick Armstrong FR/Armaflex pipe or sheet insulation as required by surface. Insulate supports from pipe to floor plate and seal insulation joints with Armstrong No. 520. Finish insulation with Armstrong Armaflex vinyl-lacquer finish.
 6. All pipe insulation shall be continuous through walls, ceiling, or floor openings or sleeves except where firestop or firesafing materials are required.
- k) Insulation of removable heads and valves, manhole access covers, HVAC and plumbing pumps, etc. shall be fabricated to allow removal without damage to insulation. Provide removable units with vapor-proof cover fabricated to be sealed to equipment vapor barrier.
 - l) Insulation failing to meet workmanship and appearance standards shall be replaced with an acceptable installation before final acceptance of project will be given. Insulation failing to meet performance requirements of this Specification for a period of one (1) year after date of final acceptance or through one (1) heating season and one (1) cooling season, whichever is longer, shall be replaced with an acceptable installation. All costs to correct insulation deficiencies and costs to repair damages to other work shall be at M/C's expense at no cost to Owner.

23-36 DUCTWORK INSULATION:

- a) Provide necessary materials and accessories for installation of interior and exterior ductwork insulation as specified and/or details on drawings. Insulation type and thickness for specific ductwork systems shall be as listed in insulation schedule in Section 23 of this Specification.
- b) Provide insulation materials manufactured by Owens-Corning, John Manville, CertainTeed, or Knauf.
- c) Insulation and application adhesives, except where specified otherwise, shall have fire and smoke hazard rating as tested by ASTM E 84 procedure not exceeding:

FLAME SPREAD	25
SMOKE DEVELOPED	50
FUEL CONTRIBUTED	50

- d) Abbreviations for manufacturers of adhesives, insulating cements, and coating specified shall be C.M. for Chicago Mastic Company, B.F. for Benjamin Foster Company and 3M for 3M Company. Average thermal conductivity is expressed in BTU/hr./sq.ft./deg F/in.
- e) Install interior duct liner insulation cut to insure tight fitting corner and longitudinal joints. Apply liner to sheet metal with 100 percent coverage of C.M. No. 17-477, B.F. No. 81-18, or 3M manufacturer's recommended application rate. Coat all edges of liner with adhesive. Provide mechanical fasteners on surfaces 18 inches or wider in addition to liner adhesive with fastener clips set flush with duct liner surface. Provide fasteners as follows:
 1. Low Velocity Ductwork (Velocities less than 2000 FPM): Provide fasteners within 3 inches of leading edge of each section 12 inches OC around joint perimeter and 3 inches from longitudinal joints at 12 inches OC. Elsewhere space fasteners 18 inches OC except not more than 6 inches from longitudinal joints nor 12 inches from corner break.

- f) Provide concealed round ductwork with exterior thermal insulation of type and thickness listed in schedule. Apply insulation to duct with C.M. No 17-477 or B.F. No. 85-20 adhesive. Provide mechanical fasteners 18 inches OC on duct width 30 inches and greater. Butt insulation joints tightly together and lap facing 2 inches over adjacent insulation and seal with vapor barrier adhesive. Seal all breaks with vapor barrier adhesive and vapor barrier tape matching insulation facing.
- g) Provide exposed rectangular ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply with mechanical fasteners spaced 12 inches OC with minimum of two (2) rows per duct side. Seal fasteners, joint breaks, and punctures with vapor barrier adhesive reinforced with 3-inch-wide vapor barrier tape matching insulation facing.
- h) Provide exposed round sheet metal ductwork with exterior thermal insulation of type and thickness listed in insulation schedule. Apply insulation with joints tightly butted together with vapor barrier adhesive. Insulate fittings with insulation thickness to equal adjoining insulation with cover overlapping 2 inches onto adjacent covering.
- i) Duct insulation materials by type shall be as follows:
 - 1. TYPE 1-DIL: Internal acoustical and thermal duct insulation for low velocity ductwork shall be CertainTeed 2-pound density Toughgard R duct liner with 0.24 BTUH thermal conductivity at 75 deg F mean temperature. Facing shall have a maximum water vapor sorption rate of 3 percent by weight. Approved for use in return air plenums, conforms to ASTM E84 requirements and withstands temperatures of 250°.
 - 2. TYPE 4-DEW: External thermal insulation for rectangular or round duct shall be CertainTeed, type 100, 1.0-pound per cubic foot density standard duct insulation complying with ASTM C 1290 and ASTM C 553 and 0.26 BTUH thermal conductivity at 75 deg F mean temperature. Provide foilscrium-kraft facing, FSK, meeting the requirements of ASTM C1136 with a maximum vapor transmission rate of 0.02 perms.
 - 3. TYPE 6-DEW: External thermal insulation for rectangular or round duct shall be Armacell, Armatuff Plus, 3-pound density, closed-cell elastomeric insulation with a white thermoplastic rubber membrane and 0.25 BTUH thermal conductivity at 75 deg F mean temperature with 0.2% water absorption. Insulation shall meet ASTM C 534 requirements and the joints shall be sealed with Armatuff 25 seal tape. Equals by prior approval only.
 - 4. TYPE 7-DEB: External thermal insulation for rectangular duct Dow Styrofoam Square Edge, extruded polystyrene with a 5.0 BTUH thermal resistance per inch at 75 deg F mean temperature. Facing shall have a maximum vapor transmission rate of 1.1 perms. Insulation shall only be used on the exterior of the building.

23-37 ELECTRICAL REQUIREMENTS:

- a) Consult Section 26B of electrical Specifications for work to be provided by E/C in conjunction with installation of mechanical equipment.
- b) Electrical work required to install and control mechanical equipment which is not shown on plans or specified under Section 26B shall be included in M/C's base bid proposal.
- c) The cost of larger wiring, conduit, control, and protective devices resulting from installation of equipment which was not used for basis of design as outlined in Section 23-A-10g of Specifications shall be paid by M/C at no cost to owner or A/E.
- d) M/C shall be responsible for providing supervision to E/C to insure that required connections, interlocking, and interconnection of mechanical and electrical equipment are made to attain intended control sequences and system operation.

- e) Furnish six (6) complete sets of electrical wiring diagrams to A/E and three (3) complete sets to E/C. Diagrams shall show factory and field wiring of components and controls. Control devices and field wiring to be provided by E/C shall be clearly indicated by notation and drawing symbols on wiring diagrams.
- f) M/C shall obtain complete electrical data on mechanical shop drawings and shall list this data on approval form which shall be presented monthly, or on request, to E/C. Data shall be complete with wiring diagrams received to date and shall contain necessary data on electrical components of mechanical equipment such as HP, voltage, amperes, watts, and locked current to allow E/C to order electrical equipment required in his contract.
- g) Safety disconnect switches and manual and magnetic motor starters shall be provided by E/C. Exceptions will be allowed where mechanical equipment is specified with these devices installed as part of factory built control systems.

23-38 RECORD DOCUMENTS:

- a) Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheers into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.
- b) The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, the following:
 - 1. Piping.
 - 2. Conduits.
 - 3. Ductwork.
- c) The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a disk or CD shall be provided to the Owner as a permanent record.
- d) As-built documents shall be submitted for approval prior to final payment. Copies of "in-progress" as-built drawings shall be submitted at each pay request.

23-39 PIPING SYSTEMS MATERIALS:

- a) Refer to Section 23 of this specification for piping material specifications and installation instructions.
- b) See schedule for specific piping materials and joining methods for systems installed under this section.

23-40 PIPING SYSTEM INSULATION SCHEDULE:

- a) Refer to Section 23 for insulation type specifications and installation instructions.
- b) See schedule for insulation types and thickness for piping installed under this section.

c) Per 2012 and 2015 International Codes:

PIPING INSULATION SCHEDULE

Service	Size	Type	Thickness
A/C Condensate Drain	Up to 2"	2-PC	0.5"
A/C Condensate Drain	2.5" & Up	2-PC	0.75"

23-41 DUCTWORK INSULATION SCHEDULE:

- a) Refer to Section 23 for ductwork insulation specifications and installation instructions.
- b) See schedule for insulation for ductwork to be insulated under this section.
- c) **Ductwork scheduled for internal lining is NOT sized on the drawings to include the lining. Size shown on the drawing is the inside duct measurement.**

DUCTWORK INSULATION SCHEDULE

System	Type	Thickness
Supply Air – Rectangular-Low Velocity	1-DIL	0.5"
Supply Air – Round	4-DEW	1.5"
Return Air – Rectangular	1-DIL	0.5"
Return Air – Round	4-DEW	1.5"
Exhaust Air – Rectangular	1-DIL	0.5"
Exhaust Air – Round	4-DEW	1.5"
Outdoor/Ventilation Air Supply– Rectangular	1-DIL	0.5"
Outdoor Air Intake – Rectangular	4-DEW	1.5"
Outdoor Air Intake- Round	4-DEW	1.5"
Exterior Ducts – Rectangular*	1-DIL/6-DEW	1"/1"
Exterior Ducts – Rectangular*	7-DEB	2"

*Provide 0.024" thick, aluminum jacket over insulation.

23-42 OPENINGS:

- a) This Contractor shall include the installation of all boxes and sleeves for openings required to install this work, excepting only structural openings incorporated in the structural drawings. Sleeves shall be installed for all pipes passing through structural slabs and walls. He shall set and verify the location of sleeves as shown on structural plans that pass through beams, only if so shown.
- b) Penetrations in walls for sheet metal ducts shall be sealed by the M/C by stuffing glass fiber into the cracks between the walls and floors, and the ducts. The exposed joints shall then be caulked on each side with non-hardening caulking such as "Tremco Acoustical Sealant." This work applies to all walls in buildings.

23-43 ACCESS PANELS:

- a) Access panels shall be provided wherever necessary to provide access to valves, traps, etc., located in concealed spaces. Each fire damper, automatic splitter damper, etc., shall have an access panel. Size shall be adequate for inspection and removal of equipment and none shall be less than 12-inch by 6-inch.

- b) Duct Access Doors: Doors shall be equivalent to CESCO Model HDD. Frame shall not be less than 22-gauge galvanized steel, with 24-gauge door panels. Doors shall have minimum 1-inch-thick insulation, PVC foam tape gaskets; zinc plated steel continuous type hinge and latches. Equivalent by American Warming and Ventilating, Cesco, Flexmaster, Greenheck, McGill Airflow, Milcor, Pottorff, Ward and Nailor will be acceptable.
- c) Wall and Ceiling Access Doors: Doors shall be equivalent to Milcor DW, concealed frame, access panels. Frame shall be 26-gauge steel with a 14-gauge door panel prime coated with electrostatic powder. Lock shall be a screwdriver operated unless a keyed lock is noted on plans. Equals by Acudor, Babcock-Davis, Cesco, Elmdor, Karp, MiFab and Nystrom.
- d) Fire Rated Wall/Ceiling Access Door: Doors shall be equivalent to Milcor UFR. Frame shall be 26-gauge galvanized bonderized steel and 20-gauge galvanized bonderized steel. Hinges shall be continuous, galvanized steel with stainless steel pin and a key operated latch. Provide automatic type door closure. Door shall have a UL rating to match rating of wall/ceiling rating. Equals by Acudor, Babcock-Davis, Cesco, Elmdor, Karp, MiFab and Nystrom.

23-44 SHEET METAL WORK:

- a) Provide G90 commercial quality prime, bright spangled galvanized sheet steel on all ductwork. Sheet metal shall be manufactured in the United States of America.
- b) Construct ductwork as detailed on drawings and as detailed in the latest edition of the Sheet Metal and Air Conditioning Contractor's Association (SMACNA) Duct Manual. Details shown on project plans shall indicate specific construction methods to be used on this project, and shall be used in lieu of any alternate methods shown in SMACNA Duct Manual.
- c) Construct and install ductwork to be completely free from vibration under all conditions of operation. Support and securely anchor ductwork and equipment from structural framing of building. Provide suitable intermediate metal framing where required between building structural framing.
- d) Each duct system shall be constructed for the specific duct pressure classifications shown on the contract documents or in equipment fan schedule listed as external total static pressure.
- e) All metal ductwork scheduled for interior thermal and acoustical liner is not sized on plans to include the proper thickness of insulation. Add 1 inch or 2 inches in height and width of ductwork to accommodate insulation thickness. Mount duct specialties such as turning vanes, damper, etc., to ductwork with the section insulated "Build Outs" to maintain continuity of thermal barrier.
- f) Construct ductwork system to conform to SMACNA Manual 23d H C Air Duct Leakage Test Manual.
- g) Where dimensions, sizes, and arrangements of elements of duct assembly and support systems are not provided herein, the Contractor shall select such to be suitable for the service. All methods and devices shall be subject to the review and approval from Engineer.
- h) Make ductwork transitions with sides sloped not to exceed a maximum of 20 degrees, 40 degrees included angle for diverging air flow and 30 degrees, 60 degrees included angle for converging air flow. Factory fabricated reduced fittings of ASME short flow nozzle design will be acceptable for round ductwork.
- i) Provide turning vanes in all elbows over 20 degrees unless otherwise noted.
- j) The Contractor shall follow the applications recommendations of the manufacturer of all hardware and accessory items and make selections of such consistent with the duct classification and services.
- k) Elbows for round ductwork shall be die formed though 8-inch diameter and 5 sections elbow 9 inches and above in diameter.

- l) Ducts shall be sealed in accordance with Table 1-2 of SMACNA Manual 1 5d. The allowable air leakage shall be in compliance with SMACNA standards for each respective duct pressure class and duct seal class. Duct sealing shall meet the following:
1. Seal level "A" requirements shall include all transverse joints, longitudinal seams, and duct wall penetrations. Pressure-sensitive tape shall not be used.
 2. Seal level "B" requirements shall include all transverse joints and longitudinal seams. Pressure-sensitive tape shall not be used.
 3. Seal level "C" requirements shall include transverse joints only.
 4. Spiral lock seams in round or flat oval ducts need not be sealed.
 5. Minimum duct sealant levels shall be as follows:

DUCT SEALANT LEVEL			
Duct Location	Supply	Exhaust	Return
Outdoors	A	C	A
Unconditioned Spaces	B	C	B
Conditioned Spaces	C	B	C

- m) All exposed round ductwork and fittings (other than mechanical or non public areas) shall be double-wall, galvanized steel, spiral lock seam, with 1-inch fiberglass insulation. Provide perforated inner liner unless a solid liner is specifically noted on plans. Outer shell shall be hot dipped galvanized steel, mill phosphatized/paint-grip sheet metal as required or noted on plans. Provide hot dipped galvanized unless specifically noted for field paint. Provide double-wall round ductwork and fittings as manufactured by United McGill or approved equal.
- n) At Contractor's option, ductwork may be joined with prefabricated galvanized "Ductmate" sections. The joint packing material and joint construction details using this method shall be submitted to the Engineer for review.
- o) All duct pressure classes shall be same as the external static pressure (ESP) of the equipment supplying the duct. The equipment ESP shall be the pressure class for the entire supply duct system.
- p) Dryer exhaust ducts shall be constructed of aluminum, connected with aluminum pop rivets and have a smooth interior finish:
1. Dryer exhaust ducts shall be installed per manufacturer's recommendations.
 2. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust airflow.
 3. The male end of the duct at overlapped duct joints shall extend in the direction of airflow.
 4. Ducts shall be a minimum nominal 4 inch diameter.
 5. Each vertical riser shall be provided with a means of cleanout.
 6. Exhaust terminations shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination.

7. Each dryer exhaust duct shall be provided with a dryer box for use as a dryer vent receptacle and cleanout. Dryer vent box shall be an In-O-Vent Technologies, Inc. "the dryer box", with model 350 or 425 for upward exhaust direction or model 3D or 4D for downward exhaust direction, or approved equivalent.

23-45 SHEET METAL SPECIALTIES:

- a) Specialties shall be factory fabricated items designed for low, medium, or high velocity systems as indicated on contract documents. Submit shop drawings on all specialties required with shop drawings of ductwork layout. Specialties shall be as follows:
 1. Turning Vanes: Aero-Dyne or equal 26-gauge HEP high efficiency profile air foil vanes mounted 2.125 inches OC on 24-gauge runners. Equals by DuctMate and Duro Dyne.
 2. Control Dampers (Round – Velocities 4000 FPM and less): Provide Ruskin Model CDRS25 dampers suitable for use in temperatures from minus 50 deg F to 200 deg F. Damper shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel for dampers up to 24-inch diameter. Damper blades shall be two (2) layers, 14-gauge galvanized steel, and include a full-circumference neoprene seal. Leakage through damper in closed position shall not exceed 0.15 cfm per inch of blade circumference at a pressure differential of 4.0" W.G. Axle shall be 0.5-inch diameter plated steel with sleeve bearing pressed into frame.
 3. Control Dampers (Rectangular – Velocities 1000 FPM and less): Provide Ruskin Model CD36 standard dampers suitable for use in temperatures from minus -25 deg F to 180 deg F. Frames shall be 5-inch by 1-inch x 16-gauge galvanized steel hat channel. Blades shall be roll formed, triple-V-groove 16-gauge galvanized steel, maximum of 6-inch wide. Axles shall be 0.5-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame. Maximum single section size shall be 48 inches wide and 72 inches high. Provide extended shaft with bracket and locking hand quadrant. When applications require more than one (1) damper section to fill opening, sections shall be interconnected by appropriate jack shafting. Blade edge seals shall be extruded dual durometer vinyl. Jamb seals shall be flexible metal, compression type. Leakage through damper in closed position shall not exceed 10 cfm per square foot of damper area at a pressure differential of 4.0" W.G.
 4. Manual Volume Dampers (Round – Velocities 1000 FPM and less): Provide Ruskin Model MDRS25 dampers suitable for use in temperatures from minus 50 deg F to 250 deg F. Damper shall be butterfly type consisting of circular blade mounted to axle. Frames shall be 20-gauge steel. Damper blades shall be 20-gauge galvanized steel. Leakage through damper in closed position shall not exceed ratings published by Ruskin. Axle shall be 0.5-inch diameter plated steel with sleeve bearing pressed into frame. All parts not protected shall be given one coat of aluminum paint. Provide 2" extended stand-off bracket and locking hand quadrant.
 5. Manual Volume Dampers (Rectangular – Velocities 1000 FPM and less): Provide Ruskin Model MD-35 standard dampers suitable for use in temperatures from minus 0 deg F to 240 deg F. Frames shall be 3-inch wide x 22-gauge or 5-inch by 1-inch x 18-gauge galvanized steel channel. Single blades shall be 22-gauge. Multiple blades shall be roll formed, triple-V-groove 18-gauge galvanized steel, maximum of 8-inch wide. Axles shall be 0.5-inch plated steel hex. Bearings shall be molded synthetic and linkage concealed in frame. Maximum single section size shall be 48 inches wide and 48 inches high. Provide 2" extended stand-off bracket and locking hand quadrant. When applications require more than one (1) damper section to fill opening, sections shall be interconnected by appropriate jack shafting.
 6. Dampers shall be Carnes, CESCO, Greenheck, Nailor, Prefco, Titus, United McGill, Louvers & Dampers Co., Pottorff or equal.
 7. Regulators: Regulators: Metropolitan RT-100, Series III, concealed damper regulators where duct is concealed in wall or ceiling. Extend the actuator cable to behind the grille or diffuser face

and anchor cable to avoid flutter. Rotary cable shall have a minimum torque service factor of 200%. Accessible cable end shall be secured with a factory furnished nylon clamp. Equal by Pottorff or Ventfabrics.

8. Counterbalanced Backdraft Dampers: Unless backdraft dampers have been specified with a piece of equipment, provide Ruskin Model CBD2 counterbalanced backdraft dampers suitable for use in temperatures to 200 deg F and pressure differentials of 40-inch W.G. for 48-inch damper widths, 6-inch W.G. for 36-inch widths, 10-inch W.G. for 24-inch widths, and 16-inch W.G. for 12-inch widths. Damper frame shall be 0.125 wall thickness 6063T5 extruded aluminum with 12-gauge steel brace at each corner. Axles shall be 0.5-inch diameter plated steel supported by ball bearings pressed into frame. Counterbalance weights shall be adjustable and mounted outboard of frame. Finish shall be mill galvanized.
9. Backdraft Dampers: Provide Ruskin Model BD2/A2 backdraft dampers suitable for use in temperatures to 250 deg F and pressure differentials of 40inch for 48-inch widths. Damper frame shall be 6063T5 extruded aluminum, 0.090 inch wall thickness, mitered corners. Blades shall be 6063T5 extruded aluminum, 0.070-inch wall thickness, and extruded vinyl edge seals.
10. Flexible Connections: Ventfabrics Ventglas prefabricated flexible indoor connection of 3.25-inch-wide heat and fire resistant neoprene coated glass fabric complying with UL standard 214 with two (2) 3-inch-wide 24-gauge metal strips attached to each edge. Provide stainless steel strips on acid exhaust fans. Indoor connector fabric shall have a minimum tensile strength of 480 lbf/inch in the warp. Ventfabrics Ventlon prefabricated flexible outdoor connection of 3.25-inch-wide heat and UV resistant Hyphalon coated glass fabric complying with UL standard 214 with two (2) 3-inch-wide 24-gauge metal strips attached to each edge. Indoor connector fabric shall have a minimum tensile strength of 530 lbf/inch in the warp and a weather-proof synthetic rubber resistant to UV rays and ozone. Provide Ventfabrics Ventel glass fabric connection with stainless steel strips on acid exhaust fans. Duro-Dyne Corporation, Ductmate, Ward Industries or approved equal will be acceptable.
11. Access Doors: Provide access doors in ductwork for access to fire dampers, smoke dampers, etc., installed under this contract. Doors and frames shall be furnished in prime coat of gray rust inhibitive paint. Frames shall be seamless one-piece galvanized mild steel. The doors shall be outer and inner panels one-piece galvanized mild steel. The door insulation shall be a minimum of 1-inch-thick. Gasket shall be positive seal and fasteners progressive action cam locks type (zinc plated). Access doors shall be Nailor, Higgins, Milcor, CESCO, or equal.
12. Low-pressure, flexible duct for connection to diffusers shall be Flex Master Type 1M flexible duct in accordance with NFPA, BOA, NFPA 90B, and UL 181, Class I Air Duct. Duct shall be factory insulated with flexible fiberglass insulation with a minimum R-value of 4.2 at a mean temperature of 75 deg F. The insulation shall be covered with a reinforced aluminum metalized vapor barrier jacket having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E 96, Procedure A. Flexible duct shall be rated for a velocity of at least 4000 feet per minute and suitable for operating temperatures of at least 250 deg F. Internal working pressure rating shall be at least 10 inches W.C. positive and 5 inches W.C. negative. Equivalent flexible ducts by ATCO, McGill AirFlow, Ward Industries, or approved equal. Maximum flexible duct length of run shall be 5 feet unless shown otherwise. Connections shall be either stainless steel bands or nylon straps. Provide vertical flexible ductwork elbows at diffusers with external support: Thermaflex Flexflow Elbow or approved equivalent. Contractor shall submit acoustic performance factors for flexible duct. Performance factors shall be equivalent to the flexible duct specified.
13. Round take-off fittings without dampers from medium, high, and low pressure rectangular ductwork shall be made with Buckley BMD or equal bell mouth fittings. HET (High Efficiency Takeoffs), Buckley Model 3300 or equal will be allowed, where rectangular duct depth noted on drawings is not 4 inches or greater than the round branch duct size. Round take-off fittings with dampers from medium, high, and low pressure rectangular ductwork shall be made with Buckley HD-BMD or equal bell mouth fittings. HET (High Efficiency Takeoffs), Buckley Model 3300-D-HD or equal will be allowed, where rectangular duct depth noted on drawings is not 4 inches or

greater than the round branch duct size. All dampers shall be provided with extended stand-off bracket, locking handle, square damper bar, and a minimum of two U-bolts. Equivalent by Barrington, SEMCO, McGill and SMC.

14. Fire Dampers (Wall/Floor): Provide at locations shown on plans, dynamic rated fire dampers constructed and tested in accordance with UL 555. Each fire damper shall have a 1.5 hour fire protection rating, 212 deg F fusible links, and shall include a UL label in accordance with established UL labeling procedures. Damper manufacturer's literature submitted for approval prior to installation shall include comprehensive performance data developed from testing in accordance with AMCA 500 and shall illustrate pressure drops for all sizes of dampers required at all anticipated air flow rates. Fire dampers shall be equipped for vertical or horizontal installation as required by the location shown. Fire dampers shall be installed in wall and floor openings utilizing steel sleeves, angles, other materials, and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions. Refer to plans for thin-line, out-of-wall, or grille access models are required. Equivalent manufacturers shall be CESCO, Prefco, Louvers & Dampers, Nailor, Pottorff or Greenheck.

- A. Low Velocity Round Dampers – Dampers for installation in round ducts shall be equal to area. Ruskin FDR25 dynamic rated to 2000 feet per minute velocity at 4.0" w.g. static pressure. At contractor's option, a Ruskin DIBD2, rectangular damper with round transitions may be provided.
- B. Low Velocity Rectangular Dampers – Dampers for installation in low velocity rectangular ducts shall be equal to a Ruskin DIBD2 dynamic rated to 2000 feet per minute velocity at 4.0" w.g. static pressure with style B, folding type blade with 100 percent free area.
- C. Medium/High Velocity Rectangular Dampers – Dampers for installation in medium/high velocity rectangular ductwork shall be equal to a Ruskin DFD60 dynamic rated to 4000 feet per minute velocity and 8.0" w.g. static pressure with airfoil blades. Provide round or oval transitions as required per the plans.

15. Ceiling Radiation Dampers: Provide at all ceiling penetrations in fire rated ceilings a UL listed fire resistance classified ceiling radiation damper. Fire dampers with 1.5 or 3 hour rating for walls or floors are not to be used in fire rated ceiling openings due to the fact they do not provide the necessary heat barrier. Dampers shall have passed UL test and be labeled such for use in any fire resisting floor or roof ceiling assembly with a restrained and/or unrestrained assembly rating of 3 hours or less. Dampers shall be supplied with 165 degree fusible links. Units installed in T-Bar ceilings or with openings larger than diffuser/grille neck size (flared out necks above ceiling) shall be complete with UL Classified thermal insulating blankets. All installation shall be in accordance with manufacturers published installation instructions and UL 555C. Dampers shall be Ruskin CFDR2 (Round) and CFD2 (Square/Rectangular) for installation in non-wood constructed ceilings and a Ruskin CFD7 (Square/Rectangular) for installation in wood constructed ceilings. Equivalent manufacturers shall be CESCO, Prefco, Louvers & Dampers, Nailor, Pottorff or Greenheck.

16. Smoke Dampers:

- A. Rectangular smoke dampers, meeting the requirements of the latest edition of UL 555S. Dampers shall be warranted against manufacturing defects for a period of five (5) years. Dampers shall be tested, rated, and labeled in accordance with the latest UL requirements. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500 and certified by AMCA (if applicable). Provide Ruskin Model SD Series smoke dampers designed with an integral angle for quick and trouble-free installation. Maintain 90 minute fire resistance rating in accordance with UL 555.

B. Smoke Rating:

- i. For velocities above 1000 feet per minute use a SD60 – Leakage Class I smoke damper in accordance with UL 555S. A Class I, airfoil blade, smoke damper leaks no more than 8 cubic feet per minute at 4-inch W.G. differential pressure.
 - ii. For velocities above 1000 feet per minute use a SD60-2 – Leakage Class II smoke damper in accordance with UL 555S. A Class II, airfoil blade, smoke damper leaks no more than 20 cubic feet per minute at 4-inch W.G. differential pressure.
 - iii. For velocities 1000 feet per minute or below use a SD36 – Leakage Class II smoke damper in accordance with UL 555S. A Class II, V-grooved blade, smoke damper leaks no more than 20 cubic feet per minute at 4-inch W.G. differential pressure.
 - C. Dampers shall have mill galvanized finish with the following accessories:
 - i. Indicator or Auxiliary Switch Packages:
 - (a) SP 100 Switch Package – Two position indicator switches linked directly to damper blade to remotely indicate damper blade position.
 - ii. DSD – Photoelectric Duct Smoke Detector: (Included for field installation)
 - iii. Factory Sleeve shall have a minimum 20-gauge thickness, minimum 17 inches long. Silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements. Provide Ductmate breakaway connections as required.
 - iv. G – Style G for dampers behind grilles with rear access.
 - v. FA – Style FA for dampers behind grilles with front access.
 - D. Equivalent manufacturers shall be CESCO, Prefco, Louvers & Dampers, Nailor, Pottorff or Greenheck.
17. Combination Fire Smoke Dampers:
- A. Rectangular combination fire smoke dampers, meeting the requirements of the latest edition of UL 555 and UL 555S. Dampers shall be warranted against manufacturing defects for a period of five (5) years. Dampers shall be tested, rated, and labeled in accordance with the latest UL requirements. Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500 and certified by AMCA (if applicable). Provide Ruskin Model FSD/RA Series combination fire smoke dampers designed with an integral angle for quick and trouble-free installation. Maintain 90 minute fire resistance rating in accordance with UL 555.
 - B. Smoke Rating:
 - i. For velocities above 1000 feet per minute use a FSD60 – Leakage Class I smoke damper in accordance with UL 555S. A Class I, airfoil blade, smoke damper leaks no more than 8 cubic feet per minute at 4-inch W.G. differential pressure.
 - ii. For velocities above 1000 feet per minute use a FSD60-2 – Leakage Class II smoke damper in accordance with UL 555S. A Class II, airfoil blade, smoke damper leaks no more than 20 cubic feet per minute at 4-inch W.G. differential pressure.
 - iii. For velocities 1000 feet per minute or below use a FSD36 – Leakage Class II smoke damper in accordance with UL 555S. A Class II, V-grooved blade, smoke damper leaks no more than 20 cubic feet per minute at 4-inch W.G. differential pressure.

- C. Elevated Temperature Rating shall be 250 deg F. Air Flow Rating shall be 2000 FPM. Construction frame shall be 5 inches by minimum 16-gauge roll formed, galvanized steel hat-shaped channel, reinforced at corners for any application (sleeve required). Blade style shall be true airfoil-shaped with opposed action. Material shall be minimum 14-gauge equivalent thickness, galvanized steel for airfoil blades or minimum 16-gauge galvanized steel for triple-V-groove, with a maximum of 6-inch width. Bearings shall be self-lubricating stainless steel sleeve, turning in extruded hole in frame. Seals shall have blade with inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450 deg F and galvanized steel for flame seal to 190 deg F. Mechanically attached to blade edge (glue-on or grip type seals are not acceptable). Jambs shall be stainless steel, flexible metal compression type. Linkage shall be concealed in frame. Axles shall be a minimum 0.5-inch (13) diameter plated steel, hex-shaped, mechanically attached to blade.
- D. Temperature Release Device: Heat-Actuated, Quick Detect:
- i. Close (in a controlled manner) and lock damper during test, smoke detection, power failure, or fire conditions through actuator closure spring. At no time shall actuator disengage from damper blades.
 - ii. Allow damper to be automatically and remotely reset after test or power failure conditions. After exposure to high temperature or fire, inspect damper before reset to ensure proper operation.
 - iii. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable.
- E. Release temperature shall be 212 deg F. Actuator shall be electric type, 120 V, 60 Hz, two-positions, fail close, with internal mounting.
- F. Dampers shall have mill galvanized finish with the following accessories:
- i. TS 150EZ Fire Stat:
 - (a) UL Classified dual temperature device allows the damper to be re-opened after initial closure from high heat.
 - (b) Electrically and mechanically locks damper in closed position when duct temperatures exceed 212 deg F.
 - (c) Allow damper to remain operable through a high limit temperature sensor for smoke management purposes while temperature is below 250 deg F or 350 deg F.
 - (d) Replaces EFL or PFL Ruskin Controlled Closure heat actuated temperature release devices on standard damper.
 - (e) Blade position indicator switches: Two position indicator switches linked directly to damper blade in order to allow remote indication of damper blade position.
 - ii. Indicator or Auxiliary Switch Packages:
 - (a) SP 100 Switch Package – Two position indicator switches linked directly to damper blade to remotely indicate damper blade position.
 - iii. DSD – Photoelectric Duct Smoke Detector: (Included for field installation)
 - iv. G – Style G for dampers behind grilles with rear access.

- v. FA – Style FA for dampers behind grilles with front access.
 - vi. Factory Sleeve shall have a minimum 20-gauge thickness, minimum 17 inches long. Silicone caulk factory applied to sleeve at damper frame to comply with leakage rating requirements. Provide Ductmate breakaway connections as required.
- G. Equivalent manufacturers shall be CESCO, Prefco, Louvers & Dampers, Nailor, Pottorff or Greenheck.
18. Louvers (Stationary): Provide Ruskin ELF375DX, 6-inch deep weather louvers. Frame and blades shall be 0.081-inch thick 6063T5 alloy extruded aluminum. Blades shall be 35 deg drainable-type and spaced at 3.5-inch centers. Jambs shall be constructed with integral downspouts for carrying water from the blades to the louver sill. Screens shall be provided on the interior of the louver and shall consist of 0.5-inch mesh 0.063-inch diameter aluminum wire mounted in aluminum frame. Louvers shall pass 1100 FPM free area velocity with less than 0.19-inch water pressure drop and shall carry less than 0.1 oz/sf of water during a 15 minute period when tested in accordance with AMCA 500. Louvers shall bear the AMCA certified ratings. Provide a 0.4 mils thick clear, anodized finish; alkyd prime coat following chemical cleaning and pretreatment; or 1.2 mils thick, baked enamel, painted finish with color as noted on plans. Louvers shall be Ruskin, Carnes, Louvers & Dampers, Cesco, Greenheck, Air Balance, Nailor, Prefco, Titus, United McGill and Vest Company, Pottorff or equal.
19. Louvers (Adjustable): Same as stationary with 0.5-inch diameter aluminum axles lock to the blades without rivets or screws. Bearings shall be heavy duty, self-lubricating nylon. Louvers shall be equipped with individual panel wing nut actuators. Provide a 0.4 mils thick clear, anodized finish; alkyd prime coat following chemical cleaning and pretreatment; or 1.2 mils thick, baked enamel, painted finish with color as noted on plans. Louvers shall be Ruskin, Carnes, Louvers & Dampers, Cesco, Greenheck, Air Balance, Nailor, Prefco, Titus, United McGill and Vest Company, Pottorff or equal.
20. Combination Louver/Damper: Provide Ruskin ELBD375, 9-inch deep weather louvers. Frame and blades shall be 0.081-inch thick 6063T5 alloy extruded aluminum. Damper blades shall be 0.25" formed aluminum. Blades shall be 35 deg drainable-type and spaced at 3.5-inch centers. Jambs shall be constructed with integral downspouts for carrying water from the blades to the louver sill. Screens shall be provided on the interior of the louver and shall consist of 0.5-inch mesh 0.063-inch diameter aluminum wire mounted in aluminum frame. Louvers shall pass 1100 FPM free area velocity with less than 0.19-inch water pressure drop and shall carry less than 0.1 oz/sf of water during a 15 minute period when tested in accordance with AMCA 500. Louvers shall bear the AMCA certified ratings. Provide a 0.4 mils thick clear, anodized finish; alkyd prime coat following chemical cleaning and pretreatment; or 1.2 mils thick, baked enamel, painted finish with color as noted on plans. Louvers shall be Ruskin, Carnes, Louvers & Dampers, Cesco, Greenheck, Air Balance, Nailor, Prefco, Titus, United McGill and Vest Company, Pottorff or equal.
21. Louvers: (Rain Driven) Provide Ruskin EME520DD, 5.5" deep weather louvers on all intake louvers on tower roof. Frame and blades shall be 0.081" thick 6063-T5 alloy extruded aluminum. Blades shall be 35 deg. drainable type and with a minimum free area of 44%. Jambs shall be constructed with integral downspouts for carrying water from the blades to the louver sill. Screens shall be provided on the interior of the louver and shall consist of 0.75" mesh 0.051" diameter aluminum wire mounted in aluminum frame. Louvers shall pass HEVAC wind driven rain test when tested in accordance with AMCA Standard 511. Louvers shall bear the AMCA certified ratings. Provide a 0.4 mils thick clear, anodized finish; alkyd prime coat following chemical cleaning and pretreatment; or 1.2 mils thick, baked enamel, painted finish with color as noted on plans. Louvers shall be Carnes, Louvers & Dampers, Cesco, Greenheck, Air Balance, Nailor, Prefco, Titus, United McGill and Vest Company, Pottorff or equal.
22. Intake/Exhaust Roof Ventilator: (Round) Provide Carnes Series GS low silhouette design in spun aluminum. Units shall be suitable for either intake or exhaust applications. Pressure drop through unit shall not exceed 0.1 inch at 750 FPM throat velocity. (Rectangular) Provide Carnes Series GI

low silhouette intake ventilator and Series GE exhaust ventilator in spun aluminum. Pressure drops shall not exceed 0.1 inch at 750 FPM (GI) and 500 FPM (GR) throat velocity. Roof curbs, backdraft dampers, anti-condensing coating, hinged covers, and bird screens shall be included with both round and rectangular units. Ventilators shall be Carnes, Loren Cook, or equal.

23-46 GRILLES, REGISTERS, AND DIFFUSERS:

- a) Provide grilles, registers, and diffusers as shown on drawings and hereinafter specified. Set all units with rubber gaskets for air tight connection with mounting surface. Unless specified or noted otherwise, grilles and registers mounted on ducts shall have standard margins. See drawings for size and quantity.
- b) Install all registers with curve of louver away from line of sight to avoid seeing into space behind louver.
- c) Install all registers in masonry construction so that bottom of register starts with masonry construction joint. Support all grilles, registers, and diffusers from Tee bars or structure so as not to stress ceiling tile. Provide proper mounting supplied and arrangements for areas shown. Check Architectural drawings for ceiling and wall construction.
- d) All grilles, registers, and diffusers shall be submitted with the following information for Engineers approval prior to installation. Any submittal found delinquent of requested information shall be returned for resubmittal:
 - 1. Airflow.
 - 2. Static Pressure Drop (maximum of 0.08-inch allowed).
 - 3. Noise Criteria Rating (maximum of 30 NC allowed).
 - 4. Throw – 230 FPM, 100 FPM, and 50 FPM.
- e) All dimensions indicated on drawings for diffuser neck sizes, face sizes, etc., are generic in nature and should be verified with equipment manufacturer prior to bid letting. Contractor shall be held responsible for compliance with specification. Should a change be required to remain in compliance with specifications, all costs incurred shall be paid by M/C.
- f) All registers and grilles shall have angled blades.
- g) Equivalent by Titus, Krueger, Anemostat, Carnes, Price, Nailor, or Tuttle & Bailey will be acceptable.
- h) See grille, register, and diffuser schedule.

23-47 EXHAUST FANS:

- a) Provide exhaust fans as indicated on drawings and schedule.
- b) Provide accessories as indicated on schedule.
- c) All belt driven fans shall be provided with a factory installed, automatic belt tensioner to maintain proper belt tension.
- d) All fans shall be AMCA certified for air and sound ratings.
- e) Equivalents by Carnes, Acme, Greenheck, Jenn Industries, Loren Cook, TwinCity Fan & Blower, or Penn Ventilation.
- f) See exhaust fan schedule.

23-48 ROOFTOP UNITS:

- a) General: Units shall meet all capacities based on conditions scheduled. Include all noted accessories on plans and with the specification.
- b) Quality Assurance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 23, "Safety Code for Mechanical Refrigeration."
 - 2. Energy Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."
 - 3. Listing and Labeling: Provide electrically operated components specified in this section that are listed and labeled:
 - A. The rooftop unit(s) shall be certified in accordance with UL 1995 and ANSI Z21.47.
 - B. The rooftop unit(s) shall be safety certified by an accredited testing laboratory and the nameplate shall carry the label of the certification agency.
- c) Warranty: A written warranty, executed by the manufacturer and signed by the Contractor, agreeing to replace components that fail in materials or workmanship, one (1) year unit, five (5) year compressors, five (5) year std heat exchanger, provided manufacturer's written instructions for installation, operation, and maintenance have been followed. Warranty period shall start at the date of substantial completion of the project.
- d) Controls:
 - 1. Controls shall allow for local and full operation of unit independent with capability for DDC control system integration. Reference points list, sequence of operations and specifications for controls requirements. Coordinate with control contractor for additional sensors and components as applicable to provide readings and inputs as listed.
- e) Rooftop Unit Curbs:
 - 1. Roof curbs shall be constructed of galvanized steel, be insulated, and a minimum of 18" high unless noted otherwise. Curbs are to be fully gasketed between the curb top and unit bottom with the curb providing full perimeter support, cross structure support, and air seal for the unit. Curb gasketing shall be furnished within the control compartment of the rooftop unit to be mounted on the curb immediately before mounting on the rooftop unit.
 - 2. Provide curb with acoustical material as noted on schedules: Two layers of 0.5" gypsum board, one layer of 4" thick mineral wool, and two layers of 0.5" gypsum board. Alternative is to provide premanufactured acoustical curb.
- f) Rooftop Units:
 - 1. Description:
 - A. Factory assembled and tested; designed for roof or slab installation; and consisting of compressor, condenser, evaporator coil, condenser and evaporator fans, refrigeration and temperature controls, gas heater, filters, and dampers.
 - 2. Construction:

- A. Unit shall be provided from the manufacturer with the supply and return air opening for connections as required on plans.
 - B. Unit shall be specifically designed for outdoor rooftop application with a fully weatherproof cabinet.
 - C. All cabinet walls, access doors, and roof shall be constructed with G90 galvanized steel with the exterior construction 20-gauge or heavier painted:
 - i. The unit shall be insulated with a minimum 0.5-inch-thick, 1 pound density insulation.
 - D. Access to filters, heating section, and other items needing periodic checking or maintenance shall be through hinged access doors with quarter turn latches. Door fastening screws are not acceptable.
 - E. Access doors shall have full perimeter gaskets.
 - F. The unit shall be furnished with a stainless steel or PVC drain pan, sloped to drain connection.
3. Fans:
- A. Blower shall be self-contained for service and removal from cabinet.
 - B. Blower and motor shall be dynamically balanced.
 - C. The motor shall have permanently lubricated ball bearings and built-in thermal overload protection.
 - D. Belt drives as provided shall be adjustable with rating of 140 percent of motor nameplate.
 - E. Provide neoprene or rubber vibration isolators for all fans.
 - F. Fan shall be provided with speed controller or VFD for all fans for balancing purposes.
4. Coils:
- A. The coils shall be fabricated of copper tubes with aluminum fins. All coils shall be leak tested to 500psi. Provide DX, reheat, and condenser coils as scheduled.
 - B. Hail guards shall be provided for all units.
5. Filters: See Division 23 for filter requirements. All unit shall be provided with aluminum mesh filter or mesh bird screen on outside air intake of unit.
6. Refrigeration System:
- A. Compressor shall be provided with internal thermal overload protection and mounted on the compressor manufacturer's recommended rubber vibration isolators.
 - B. System shall be equipped with automatic reset low pressure and manual reset high pressure refrigerant controls.
 - C. Unit shall be equipped with Schrader type service fittings on both the high side and low pressure sides of the system.
 - D. Units shall be provided with Type 410A or 407 refrigerants.

- E. Unit shall be equipped with refrigerant liquid line driers as required.
 - F. Units over 7 tons shall be multiple stage with minimum of two stages of control or as noted in the schedule
7. All dedicated outside air units shall have digital school or modulating compressors for 20-100% modulation unless otherwise noted. Dedicated 100 percent outside air units shall be capable of dehumidification with supply of neutral air unless otherwise noted.
8. Gas Heat Section:
- A. Unit shall heat using natural gas fuel and with a minimum one stage of heat capacity with minimum of 80 percent efficiency.
 - B. Unit shall be provided with a gas heating furnace consisting of a heat exchanger, an induced draft blower, and an electric pressure switch to lockout the gas valve until the combustion chamber is purged and combustion air flow is established.
 - C. Unit shall be provided with a gas ignition system consisting of an electronic igniter to a pilot system, which will be continuous when the heater is operating, but will shut off the pilot when heating is not required.
 - D. All dedicated outside air units shall have stainless steel burners and 439 stainless steel tubes with 25 year heat exchanger warranty. Gas burners shall be modulating with a min of 8:1 turndown.
9. Power Requirement:
- A. Unit shall be provided with a factory installed and wired disconnect switch or circuit breaker with an access handle on the exterior of the cabinet. Provide convenience receptacle that retains power when disconnect to unit is switched off. Provide for single power connection with internal control transformer with built-in overcurrent protection unless otherwise noted.
 - B. Provide unit with voltage/phase monitor for all units. Units shall shut-down and automatically restart with phase unbalanced protection, over/under/brown out voltage protection, and phase loss/reversal.
10. Provide economizer as scheduled. Outside air economizer shall be fully modulating economizer providing differential enthalpy control for free cooling. The outside air damper and return air damper assembly shall be constructed of extruded aluminum, blades with rubber edge seals, and aluminum end seals. Damper motor shall be spring return to ensure closing of outdoor air damper during periods of unit shut down or power failure.
11. Energy recovery wheel performance (where scheduled on drawings) shall be AHRI 1060 certified UL listed and bear the AHRI certified label and provided as part of equipment package. The rotor media shall be light weight and must be made of aluminum or stainless steel. Paper or fibrous media are not acceptable. All surfaces must be coated with a adsorbent layer of desiccant prior to being formed into the media structure to ensure that all surfaces are coated. The desiccant must be designed for the adsorption of water vapor. The media shall be cleanable by vacuuming the media surface, without degrading the latent recovery. Where scheduled provide total energy wheel, supply, and exhaust blower filter and hoods as required. Include frost protection, low ambient operate and one (1) year warranty. Wheel shall be removable for cleaning through hinged service access door.
12. Provide modulating hot gas reheat, electric preheat, receptacle, smoke detectors/fan shut-down relay, or other options as scheduled.

13. Equivalent units by Aeon, Trane, York, or Carrier.

14. Installation:

- A. Install Roof Curbs on roof structure, level and secure according to requirements of roofing manufacturer. Install rooftop unit level on structural curbs and coordinate roof penetrations and flashing. Coordinate roof constructions type with roofing specifications.
- B. Install condensate drain, minimum connection size, with trap and indirect connection to nearest roof drain or gutter.
- C. Install piping adjacent to rooftop units to allow service and maintenance.
- D. Gas piping shall comply with applicable requirements in division 22. Connect gas piping to burner, full size of gas train inlet and connect with union and shutoff valve and minimum 3-inch dirt leg with sufficient clearance for burner removal and service.
- E. Duct installation requirements are specified in other division 23 sections. Drawings indicated the general arrangement of ducts. The following are specific connection requirements:
 - i. Install ducts to termination at top of roof curb.
 - ii. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
 - iii. Connect supply air ducts to rooftop units with flexible duct connectors.
 - iv. Install return air duct continuously through roof structure.
- F. Engage a factory authorized service representative to inspect, test and adjust components, assemblies and equipment installation, including connections. Report tests in writing.
- G. After installing rooftop units and after electrical circuitry has been energized test units for compliance with requirements.
- H. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- I. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment
- J. Remove and replace malfunctioning units and retest as specified above.
- K. When requested within 12 months of date of substantial completion, provide on-site assistance in adjusting system to suite actual occupied conditions. Provide one visit to site during other than normal occupancy hours for this purpose.

23-49 TESTING AND BALANCING PREPARATION:

- a) The M/C shall prepare the system for test and balance as follows:
 - 1. Install, start-up, check out, and adjust all HVAC systems per drawings and specifications and have fully operational with all deficiencies corrected on or before Owner's substantial completion date.
 - 2. Verify that M/C has installed new filters no more than one day prior to starting test and balance procedure.

3. Verify that all ductwork is clean and sealed tight against leaks.
 4. Verify that all controls, dampers, and actuators are installed, adjusted, and calibrated.
 5. Secure control dampers after test and balance.
- b) The following checks shall be performed on each system installed under this contract:
1. Air Handling Systems:
 - A. Clear system of all foreign objects and clean system.
 - B. Verify fan rotation.
 - C. Check bearing condition and lubrication.
 - D. Check fan wheel clearances and fan alignment.
 - E. Check motor security to mounting base.
 - F. Check alignment of drive.
 - G. Check vibration isolator adjustment.
 - H. Verify that proper filter media is installed.
 - I. Verify that all control dampers are installed and operable without binding or sticking.
 - J. Confirm that all fire, smoke, and volume dampers are installed and in full open position.
 - K. Verify that all air re-heat coils and fan coil units are installed.
 - L. Confirm that all air openings in walls above ceilings have been provided.
 - M. Check for and repair all excessive air leaks in duct systems, at equipment connections and at coils. Air leaks shall not exceed SMACNA parameters for system pressure.
 - N. Verify that all ductwork is constructed and installed in accordance with contract drawings and/or approved ductwork shop drawings.
- c) The M/C shall make changes in pulleys, belts, dampers, etc., as required by the balance contractor, at no additional cost to the Owner.
- d) The M/C shall install new filters in the air handlers and clean all strainers in the water system just prior to the beginning of the test and balancing.
- e) The control manufacturer, or his representative, shall assist the balance contractor in setting automatic dampers, valves, etc., as required:
1. Bring all fans to design RPM.
 2. Bring air volume in each air handling system to the design air volume using Pitot tube transverse method within a minimum of 26 traverse points.
 3. Test and record fan motor data.
 4. Test and record static pressure and air volume in high velocity duct extremities.

5. Bring air diffusers and registers to design CFM.
6. Make recommendations for system modifications and adjustments required to facilitate proper system balancing as determined by preceding test.
7. Retest and readjust all system segments affected by system modifications.
8. Bring water systems, including pumps, to design flows.
9. Adjust return air flows where dampers are provided.

23-50 AIR SYSTEM TESTING AND BALANCING:

- a) All air supply, return and exhaust systems, domestic hot water, and hot and chilled water systems shall be balanced and adjusted to meet capacity and condition shown in construction documents. This work shall be performed by an independent testing and balancing agency certified by AABC or NEBB.
- b) M/C shall submit name of testing and balancing agency to A/E for approval prior to bid performance of work.
- c) Balancing shall be performed and report in accordance with latest specification for testing and balancing for air systems and hot water systems, as it pertains to systems installed on this project.
- d) Balancing and test reports shall be submitted on standard AABC or NEBB forms.
- e) The following balancing contractors will be accepted for this project. No other contractors shall be allowed unless approved by Engineer:
 1. Systems Testing and Analysis – Richard Miller (314) 567-6011.
 2. Miller Certified Air – David Miller (314) 352-8981.
 3. Precisionaire of the Midwest, Inc. – David Keller (816) 847-1380.
 4. TABCO – Harry Gaines (417) 443-4430.
 5. Total Air Balance – Bill Trotter (417) 207-9999.
 6. Pro Balance – Duke Yokum (816) 228-7800.
 7. C&C Group – Steve Corte (417) 429-4160.

23-51 CONDENSATE DRAINS

- a) Provide as shown on drawings with materials as indicated in schedule. Condensate drains shall be trapped as required by the equipment or appliance manufacturer.
- b) Piping shall be no smaller than the drain connection of the device and at least 0.75" in diameter. Piping shall not decrease in size from the drain pan to the place of condensate disposal.
- c) Horizontal runs shall slope at least 1/8" per foot in the direction of discharge.
- d) Piping shall be supported as required for pipe size and material to eliminate pipe sagging.
- e) Provide a capped, 0.75", cleaning port with flair fitting at each equipment connection for cleaning of drain lines.

23-52 BUILDING AUTOMATION SYSTEM:

- a) Control system shall be a networked control system for system management including setpoint limitations, scheduling, and alarm notification. Provide all thermostats, devices, controllers, interfaces, power supplies, wiring, equipment, etc for networked hvac units. Rooftop units shall run independently/stand alone from local thermostats but shall be capable of minimum 365 day occupancy schedule setup via BAS interface. Include all programming for complete and operational system. Incorporate all owner/user defined setpoints, schedules, etc. System shall be by Orion, Trane Trace, WattMaster, Honeywell or approved equal.
- b) Units connected to the system shall include:
 - A. Rooftop Units
 - B. Exhaust fans
- b) Provide networking thermostats compatible with controls for interconnection with low voltage cable daisy chained together. Include central station manager on site as well as IP network link for web based software for remote monitoring. All cable shall be plenum rated.
- c) An interface device shall be provided to allow both a computer and modem connection to the system. The interface shall provide two connections for simultaneous connection of PC and modem. The interface shall also provide automatic remote notification via sms or email when alarm conditions occur in the control system. Both local and remote PC connections may be active simultaneously.
- d) A web browser graphics software package shall be provided, programmed and customized to the end user. Software shall be compatible with Microsoft's Windows operating system. A fully functioning licensed copy of the software with a user manual shall be included along with a copy of the software. The software shall not be copy protected as to restrict its installation on multiple computers. Software shall not require an external hardware key or device in order to operate. The software shall provide the following features and functions:
 - 1. Preprogrammed Status Screens
 - 2. Menu Driven, Fill in the blank Programming for all system values & setpoints
 - 3. User definable, English language descriptors for all controller locations
 - 4. User friendly setup for on site or remote communications
 - 5. Multiple Levels of Password Protection
 - 6. Automatic alarm notification via sms or email with remote response capabilities
 - 7. Remote connection setup for multiple building sites
 - 8. Graphics Editor
 - 9. Trend Log Setup
 - 10. Automatic Trend Log Retrieval
 - 11. Download of Trend Logs to CSV Format for importing into spreadsheets
 - 12. Fill in the Blank Schedule Programming
 - 13. Point & Click Programming of Holiday Schedules
 - 14. Automatic Air Balance Force Modes
 - 15. Diagnostic Counters
 - 16. Alarm Logging
 - 17. User Access Logging

END OF DIVISION 23

DIVISION 26 – ELECTRICAL

26-1 CONTRACT DOCUMENTS:

- a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Electrical Contractor and his subcontractors and material suppliers.

26-2 SPECIFICATION FORM AND DEFINITIONS:

- a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- c) “Provide” means furnish and install.
- d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- e) Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants LLC., 3333 E. Battlefield Suite 1000 Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Anthony G. Beier
- g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.
- i) Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.
- j) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.

26-3 GENERAL EXTENT OF WORK:

- a) Provide electrical systems indicated on drawings, specified or reasonably implied. Provide every device and accessory for proper operation and completion of mechanical systems. In no case will claims for “Extra Work” be allowed for work about which E/C could have informed himself before bids were taken.
- b) E/C shall familiarize himself with equipment provided by other contractors, which require electrical connections and controls.
- c) Make required electrical connections to equipment provided under Architectural and mechanical divisions of this project, except where shown or specified otherwise. Make required internal field wiring modifications indicated on wiring diagrams of factory installed control system for control sequence specified. These field modifications shall be limited to jumper connections and connection of internal wiring to alternate terminal block lugs. Cost for field modifications requiring re-wiring of factory installed control systems for equipment provided by G/C or M/C shall be included in base bid of each respective contractor.

- d) Check electrical data and wiring diagrams received from M/C for compliance with project voltages, wiring, controls, and protective devices on electrical drawings. Promptly bring discrepancies found to attention of A/E for a decision.
- e) Provide safety disconnect switches, contactors, and manual and magnetic motor starters (starters are required for any motor 3/4hp or larger) for all mechanical and electrical equipment requiring such devices, whether specifically scheduled or shown on the drawings or not – no adds shall be paid for this equipment required for proper operation of the equipment after the bid. Coordinate with the M/C and omit these devices only where they are included as part of the equipment, unless scheduled otherwise on the drawings, and only where approved by the A/E. Where approval has not been obtained from the A/E prior, include all costs for this equipment in the base bid. With exception of factory installed devices, provide safety disconnect switches, contactors, and motor starters by one manufacturer to allow maximum interchangeability of repair parts and accessories for these devices.
- f) Coordinate closely with M/C and P/C for all mechanical, plumbing and/or HVAC equipment overcurrent protection. Where the provided equipment is listed with a 'Maximum Fuse Size', a fused disconnect switch shall be provided with fuses sized per the manufacturer's listing, regardless of what is shown on the drawings. Where the equipment is listed with a 'Maximum Overcurrent Protection (MOCP)', a fused or non-fused disconnect switch shall be provided as indicated and scheduled on the drawings. Include all costs as necessary for coordination with the M/C and including appropriate disconnecting means as required. Where overcurrent or disconnecting means sizes on the electrical drawings do not match the mechanical or plumbing drawings or the provided equipment, the E/C shall include costs for the larger sizes (including upsizing wiring and conduit to match overcurrent size) in the base bid. Notify the A/E in all instances.
- g) Coordinate closely with M/C and P/C for all mechanical, plumbing and/or HVAC equipment electrical connection. Disconnecting means as indicated on the drawings is shown schematically. E/C shall verify mounting location and equipment connection points with the M/C and connect all equipment per the manufacturer's requirements. E/C shall verify mounting location of all disconnecting means with the E/M and install per those requirements and so as not to impact equipment performance, access, operation and/or warranty. Disconnecting means shall be installed in an accessible location as required by the National Electric Code. Provide structural supports securely attached to the building structure separate from mechanical equipment and/or supports for mounting of disconnecting means as required and include costs for all such supports and associated equipment in the base bid. Maintain all conduit and conductor feeds to equipment concealed inside the building or below grade, and stub up at the equipment inside the curb or at equipment supports. Unistrut shall not be allowed for any roof penetrations.
- h) Coordinate closely with G/C, M/C and P/C for all electrical, lighting, mechanical, plumbing and/or HVAC equipment locations. Refer to the mechanical, plumbing and architectural plans for exact locations and quantities of all hvac equipment, plumbing equipment, smoke dampers, fire/smoke dampers, pumps, miscellaneous equipment, etc. Locations and quantities shown on the electrical drawings are approximate and may not reflect final position or quantity. The electrical contractor shall be responsible for familiarizing himself with all drawings and specifications in the construction documents, not just the electrical drawings. The electrical contractor shall provide final connection to all equipment and lighting. Where equipment or lighting is shown on the mechanical, plumbing or architectural plans but not shown on the electrical plans, electrical contractor shall provide power to the equipment based on equipment requirements as scheduled or noted, specified and/or per the manufacturer's requirements and include all costs in the base bid. Location shown of electrical connection to mechanical, plumbing or other equipment is schematic and may not reflect actual connection points. Rough-in and connection to the equipment shall be per the equipment manufacturer's requirements, the National Electric Code and as required to keep electrical connections concealed from view. All rough-in requirements shall be verified with the respective contractor and equipment manufacturer prior to any work being performed.
- i) Electrical controls in boiler rooms, equipment rooms, and control rooms shall be grouped in accessible locations and arranged according to function. Where possible use group control panels and combination starters in lieu of individually enclosed devices.

- j) All electrical work as required to provide temporary power for construction shall be the responsibility of the electrical contractor. Include all costs as required in the base bid. Coordinate and verify all requirements with the general contractor.

26-4 LOCAL CONDITIONS:

- a) Visit site and determine existing local conditions affecting work in contract.
- b) Failure to determine site conditions or nature of existing or new construction will not be considered a basis for granting additional compensation.

26-5 CODES, ORDINANCES, RULES, AND REGULATIONS:

- a) Provide work in accordance with applicable codes, rules, ordinances, and regulations of Local, State, and Federal Governments and other authorities having lawful jurisdiction.
- b) Conform to latest editions and supplements of the following codes, standards, or recommended practices.

1. CITY CODES:

- A. 2006 International Building Codes
- B. 2006 International Fire Code

2. SAFETY CODES:

- A. National Electric Safety Code Handbook H30 – National Bureau of Standards.
- B. Occupational Safety and Health Standards – Department of Labor.
- C. Specifications for Making Buildings and Facilities Accessible To, and Usable By, the Physically Handicapped – American Standards Institute ANSI A117.1.

3. NATIONAL FIRE CODES:

- A. NFPA No. 70 – National Electric Code – 2005 Edition.
- B. NFPA No. 101 – Life Safety Code – 2012 Edition.

4. UNDERWRITERS LABORATORIES, INC.:

- A. UL 508 – Standards for Industrial Control Equipment.
- B. All materials, equipment and component parts of equipment shall bear UL labels whenever such devices are listed by UL.

- c) Drawings and specifications indicate minimum construction standards, but should any work indicated be sub-standard to any ordinances, laws, codes, rules, or regulations bearing on work, E/C shall promptly notify A/E in writing before proceeding with work so that necessary changes can be made. However, if E/C proceeds with work knowing it to be contrary to any ordinances, laws, rules, and regulations, he shall thereby have assumed full responsibility for and shall bear all costs required to correct non-complying work.
- d) E/C shall secure and pay for necessary permits and certificates of inspection required by governmental ordinances, laws, rules, or regulations. Keep a written record of all permits and inspection certificates and submit two (2) copies to A/E with request for final inspection.

26-6 CONTRACT CHANGE:

- a) Changes or deviations from contract, including those for extra or additional work must be submitted in writing for review of A/E. No verbal orders will be recognized.
- b) Changes in the work shall be submitted in accordance with AIA Document A201, General Conditions of the Contract for Construction.
- c) All change proposals shall be itemized indicating separately the costs for materials, labor, restocking charges, freight, bonds, insurance, overhead, and profit. All materials shall be listed separately with quantities and individual unit prices. Labor factors shall be from a nationally recognized source with appropriate adjustments.
- d) All submitted breakdowns shall be broken out individually for labor and material for each separate line item in the respective supplemental instruction, contract change directive, or proposal request. Items submitted with lump sums will be returned unreviewed.
- e) The maximum allowable profit for any change order shall be ten percent (10%).
- f) See Example below:

PRICING SHEET

Project:	Cassville Performance Arts Center			Date:	March 1, 2023	
Location:	Cassville, Missouri			Estimator:	Jane Doe	
Labor Rate:	\$22.00					

Material	Units	Unit Measure	Material Per Unit	Man Hours Per Unit	Total Man Hours	Materials Total
Add						
Drill & Patch Holes	1	lot	\$1,285.00	3.000	3.00	\$1,285.00
4" LB w/cover	6	ea	\$105.23	2.750	16.50	\$631.38
4" Compr. Conn	6	ea	\$87.70	1.000	6.00	\$526.20
4" GRC	40	ea	\$9.04	0.280	11.20	\$361.57
4" cut & thread labor	4	ea	\$0.00	1.600	6.40	\$0.00
4" GRC-PVC Adptr.	16	ea	\$4.70	0.675	10.72	\$75.20
4" GRC 90 Ell	4	ea	\$56.34	1.500	6.00	\$225.36
4" Sch 40 PVC	460	ea	\$2.25	0.600	27.60	\$1,034.03
Resocking Fee 20%	1	lot	\$212.26	0.00	0.00	\$212.26
Return Freight	1	lot	\$26.40	0.000	0.000	\$26.40
Deduct						
4" EMT	-330	ea	\$2.46	0.045	(14.85)	(\$812.79)
4" EMT 90 Ell	-6	ea	\$26.64	1.100	(6.60)	(\$159.84)
4" EMT Cplg	--39	ea	\$2.27	0.270	(10.53)	(\$88.66)
SUBTOTAL					55.44	\$3316.12
SALES TAX					6.125%	\$203.11
LABOR					55.4	\$1,205.27
5% OVERHEAD						\$236.23
8% PROFIT						396.86
TOTAL						\$5357.59

26-7 LOCATIONS AND INTERFERENCES:

- a) Locations of equipment, piping, and other mechanical work are indicated diagrammatically by electrical drawings. Lay out work from dimensions on Architectural and Structural Drawings. Verify equipment size from manufacturer's shop drawings.
- b) Study and become familiar with contract drawings of other trades and in particular the general construction drawings and details to obtain necessary information for figuring installation. Cooperate with other workmen and install work to avoid interference with their work. Minor deviations not affecting design characteristics, performance, or space limitations may be permitted if reviewed by A/E prior to installation.
- c) Any conduit, apparatus, appliance, or other electrical item interfering with proper placement of other work as indicated on drawings, specified, or required shall be removed and if so shown, relocated and reconnected without extra cost. Damage to other work caused by the E/C, his subcontractor, his workmen, or by any cause whatsoever, shall be restored as specified for new work.
- d) Do not scale mechanical and electrical drawings for dimensions. Accurately lay out work from dimensions indicated on architectural drawings unless such is found in error.

26-8 SYSTEM PERFORMANCE:

- a) Final acceptance of work shall be subject to the condition that all systems, equipment, apparatus, and appliances operate satisfactorily as designed and intended; work shall include required adjustment of systems and control equipment installed under this specification.

26-9 WARRANTY:

- a) E/C warrants to Owner and Architect the quality of materials, equipment, workmanship, and operation of equipment provided under this specification division for a period of one (1) year from and after date of substantial completion of building and acceptance of mechanical systems by Owner.
- b) Where manufacturers' warranties expire before or during the one-year warranty period as specified in item a, the E/C shall include provisions for extending the manufacturer's warranty as required to match the one-year period from substantial completion and shall include cost for warranty extension in his base bid.
- c) E/C warrants to Owner and Architect that on receipt of written notice from either of them within one (1) year warranty period following date of acceptance, all defects that have appeared in materials and/or workmanship shall be promptly corrected to condition required by contract documents at E/C's expense.
- d) The above warranty shall not supersede any separately stated warranty or other requirements by law or by these specifications.
- e) Keeps an itemized list of all equipment warranties listing equipment by name, mark, and type along with length and expiration date of each warranty. Submit two (2) copies to A/E with request for final inspection.
- f) If the Architect's specification includes a warranty that exceeds the above warranty requirements, the Architect's warranty shall take precedence.

26-10 MATERIALS, EQUIPMENT, AND SUBSTITUTIONS:

- a) The intent of these specifications is to allow ample opportunity for E/C to use his ingenuity and abilities to perform the work to his and the Owner's best advantage, and to permit maximum competition in bidding on standards of materials and equipment required.

- b) Material and equipment installed under this contract shall be first class quality, new, unused, and without damage.
- c) In general, these specifications identify required materials and equipment by naming first the manufacturer whose product was used as the basis for the project design and specifications. The manufacturer's product, series, model, catalog, and/or identification numbers shall set quality and capacity requirements for comparing the equivalency of other manufacturer's products in general. Where models are listed or scheduled with information that does not match specified manufacturer's data, the larger, more expensive and/or restrictive requirement between the schedule and the manufacturer's data shall be met and included. Where other manufacturer's names are listed, they are considered an approved manufacturer for the product specified; however, the listing of their names implies no prior approval of any product unless specific model or catalog numbers are listed in these specifications or in subsequent addenda. The naming of a manufacturer, or even a model number, does not alleviate the contractor from being required to meet or submit equipment which meets all of the criteria and items listed in the specifications or shown on the plans even if the specified model and/or manufacturer does not. All requirements on the drawings must be met, not just the specific model number or manufacturer. Where other than first named products are used for E/C's base bid proposal, it shall be his responsibility to determine prior to bid time that his proposed materials and equipment selections are products of approved manufacturers, which meet or exceed the specifications, fit physically in the spaces provided, are compatible with all other systems and are acceptable to the D/E.
- d) Where varying or conflicting information, notes or specifications may be shown in different locations on the drawings, schedules, or specifications, all requirements are required to be met and the worst case or more expensive and/or restrictive option should be included where duplicate information is not the same. Notify A/E for clarification.
- e) Where materials or equipment are described but not named, provide required items of first quality, adequate in every respect for intended use. Such items shall be submitted to A/E for review prior to procurement.
- f) PRIOR TO RECEIPT OF BIDS, IF E/C WISHES TO INCORPORATE PRODUCTS OTHER THAN THOSE NAMED IN SPECIFICATIONS IN HIS BASE BID, HE SHALL SUBMIT A WRITTEN REQUEST FOR REVIEW OF SUBSTITUTIONS TO D/E NOT LESS THAN SEVEN (7) WORKING DAYS PRIOR TO BID TIME. D/E WILL REVIEW REQUESTS AND ACCEPTABLE ITEMS WILL BE LISTED IN AN ADDENDUM ISSUED TO PRINCIPAL BIDDERS.
- g) Materials and equipment proposed for substitutions shall be equal to or superior to that specified in construction, efficiency, utility, aesthetic design, and color, as determined by A/E, whose decision shall be final and without further recourse. Physical size of substitute brand shall be no larger than space provided including allowances for access for installation and maintenance. Requests must be accompanied by two (2) copies of complete descriptive and technical data including E/M's name, model, and catalog number, photographs or cuts, physical dimensions, operating characteristics, and any other information needed for comparison.
- h) In proposing a substitution prior to or subsequent to receipt of bids, include in such proposal cost of altering other elements of project, including (but not limited to) adjustments in mechanical, electrical, plumbing, controls, fire alarm and/or any other service requirements necessary to accommodate such substitution; whether such affected elements are under this contract or under separate contracts.
- i) Within seven (7) working days after bids are received, apparent lower bidder shall submit to A/E for approval three (3) copies of a list of all major items of equipment he intends to provide. As soon as practicable and within 30 working days after award of contract, E/C shall submit shop drawings for equipment and materials to be incorporated in work, for A/E review. Where 30 day limit is insufficient for preparation of detailed shop drawings on major equipment or assemblies, E/C shall submit manufacturer's descriptive catalog data and indicate date such detailed shop drawings will be submitted along with manufacturer's certification that order was placed within 30 working day limit.

- j) After execution of contract, substitution of product brands for those named in Specifications will be considered, only if:
1. Request is received within 30 days after contract date and request includes statement showing credit due Owner, if any, if substitution products are used, or
 2. Owner requests consideration be given to substitute brands.

26-11 SHOP DRAWINGS, OPERATION, AND MAINTENANCE INSTRUCTION:

- a) E/C shall furnish a minimum of six (6) sets of shop drawings of all materials and equipment, A/E will retain two (2) sets.
- b) Where catalog cuts are submitted for review, conspicuously mark or provide schedule of equipment, capacities, controls, fittings, sizes, etc., that are to be provided. Mark each submitted item with applicable section and paragraph numbers of these specifications, or plan sheet number, when item does not appear in specifications. Where equipment submitted does not appear in base specifications or specified equivalent, submittals shall be marked with applicable alternate numbers, change order numbers, or letters of authorization. Each submittal shall contain at least two (2) sets of original catalog cuts. Each catalog sheet shall bear E/M's name and address. All shop drawings on materials and equipment listed by UL shall indicate UL approval on submittal.
- c) E/C shall check all shop drawings to verify that they meet specifications and/or drawing requirements before forwarding submittals to the A/E for their review. All shop drawings submitted to A/E shall bear E/C approval stamp which shall indicate that E/C has reviewed submittals and that they meet specification and/or drawing requirements. E/C's submittal review shall specifically check for, but not be limited to, the following: equipment capacities, physical size in relation to space allowed; electrical characteristics, provisions for supply, return, and drainage connections to building systems. All shop drawings not meeting E/C's approval shall be returned to his supplier for resubmittal.
- d) No shop drawing submittals will be considered for review by the A/E without E/C's approval stamp, or that have extensive changes made on the original submittal as a result of E/C's review.
- e) A/E will not be responsible for the cost of returning shop drawing submittals that are submitted to them without E/C's review and approval stamp. A letter will be sent to E/C by either the Architect or Engineer indicating receipt of an improper submittal. E/C shall acknowledge receipt of letter and indicate his plans for pick-up or resubmitting. A/E will hold improper submittals for pick-up by E/C or supplier for 15 working days after date of receipt. If not picked up by the 16th working day, submittals will be disposed of by A/E.
- f) A/E's review of shop drawings will not relieve E/C of responsibility for deviations from drawings and specifications unless such deviations have been specifically approved in writing by Owner or his representative, nor shall it relieve E/C of responsibility for errors in shop drawings. No work shall be fabricated until A/E's review has been obtained. Any time delay caused by correcting and resubmitting shop drawings will be E/C's responsibility.
- g) Operating and Maintenance Instructions:
1. Submit with shop drawings of equipment: copies of installation, operating, maintenance instructions, and parts list for equipment provided. Instructions shall be prepared by E/M.
 2. Keep in safe place keys and wrenches furnished with equipment under this contract. Present to Owner and obtain a receipt for same upon completion of project.
 3. Contractor shall provide all final documents including drawings, shop drawings, etc., in PDF format on a single disk to Owner. A total of five (5) CD's shall be provided, three (3) to the Owner and two (2) to A/E. No exceptions will be allowed to this requirement. Videotaping, as specified in other parts of this specification, will also be required at closeout.

26-12 PROPOSED VALUE ENGINEERING/PROJECT SCOPE REVISIONS:

- a) Where design revisions are requested/required based on value-engineering or proposed changes in project scope, the contractor shall include in his proposed cost savings or adds the necessary MEP design fees that are required for modifying construction documents and associated meetings. In order to determine that value to be included, the contractor shall submit to the A/E the proposed scope of the work required for the changes at least 7 days prior to required pricing submittal so that the design fees can be accurately determined and included. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.
- b) Where the contractor proposes to use different size equipment, feeders, feeder materials, circuit breakers, fuses or significant difference in routing of feeders or branches than shown in the construction documents, the contractor shall include the necessary MEP design fees that are required for modifying or creating construction drawings necessary either for construction or submission to the authority having jurisdiction and required for additional review. Design work and drawing changes will only commence once the design fee is established and a signed agreement returned to the A/E for inclusion.

26-13 CAD FILE REQUESTS:

- a) CAD files are the property of the D/E. CAD files are only available upon documented written request which must be forwarded to the D/E office. Prior to receiving any CAD files, the contractor shall submit a drawing cost fee of \$50 per construction drawing up to a maximum \$1500. In addition, the contractor must sign a Second Party User Agreement and Drawing Request Form (available upon request from our office) which must be forwarded back to the D/E office prior to any CAD files being released. BIM/Revit models will not be made available.

26-14 CUTTING AND PATCHING:

- a) Contractor shall do cutting and patching of building materials required for installation of work herein specified. Cut no structural members without Architect's approval and in a manner approved by him.
- b) Patching shall be by mechanics of particular trade involved and shall meet approval of Architect.
- c) Drilling and cutting of openings through building materials requires Architect's review and approval. Make openings in concrete with concrete hole saw or concrete drill. Do not use star drill or air hammer for this work.

26-15 MUTILATION:

- a) Mutilation of building finishes, caused by installation of electrical equipment, fixtures, outlets, and other electrical devices shall be repaired at E/C's expense to approval of Architect.

26-16 EXCAVATION AND BACKFILL:

- a) Perform necessary excavating to receive work. Provide necessary sheathing, shoring, cribbing, tarpaulins, etc., as required and remove same at completion of work. Perform excavation in accordance with appropriate section of these specifications, and in compliance with OSHA Safety Standards.
- b) Excavate trenches of sufficient width to allow ample working space, and no deeper than necessary for installation work.
- c) Conduct excavations so no walls or footings are disturbed or injured. Backfill excavations made under or adjacent to footings with selected earth or sand and tamp to compaction required by A/E. Mechanically tamp backfill under concrete and paving in 6-inch layers to 95 percent standard density.
- d) Backfill trenches and excavations to required heights with allowance made for settlement. Tamp fill material thoroughly and moisten as required for specified compaction density. Dispose of excess earth, rubble, and debris as directed by Architect.

- e) When available, refer to test-hole information on Architectural drawings or specifications for types of soil to be encountered in excavation. Where rock is indicated, list unit cost for rock excavation in base bid.

26-17 SETTING, ADJUSTMENT, AND EQUIPMENT SUPPORTS:

- a) Work shall include mounting, alignment, and adjustment of systems and equipment. Set equipment level on adequate foundations and provide proper anchor bolts and isolation as shown, specified. Level, shim, and grout equipment bases as recommended by E/M. Mount motors, align and adjust drive shafts and belts according to E/M's instructions. Equipment failures resulting from improper installation or field alignment shall be repaired or replaced by E/C at no cost to Owner.
- b) Provide concrete bases for all floor and slab mounted equipment. Refer to drawings for require base type and size. Provide 3.5-inch high base where base is not shown on drawings.
- c) Provide each piece of equipment or apparatus suspended from ceiling or mounted above floor level with suitable structural support, platform, or carrier in accordance with best recognized practice. E/C shall arrange for attachment to building structure, unless otherwise indicated on drawings or specified. Provide hangers with vibration eliminators. Contractor shall verify with structural engineer that structural members of buildings are adequate to support equipment. Submit details of hangers, platforms, and supports together with total weights of mounted equipment to structural engineer and A/E for review before proceeding with fabrication or installation.
- d) Supports and/or support wires for electrical equipment, raceways, light fixtures, etc. shall be designated (painting is acceptable) separately from supports and/or support wires for other building systems. All supports and/or support wires shall be designated the same throughout the project.

26-18 START-UP, CHANGE-OVER, TRAINING, AND OPERATIONAL CHECKS:

- a) E/C shall perform initial start-up of systems and equipment. Personnel qualified to start-up and service this equipment, including E/M's technicians, when specified, and Owner's operating personnel shall be present during these operations.
- b) E/C shall be responsible for training Owner's operating personnel to operate and maintain systems and equipment installed. Keep a record of training provided to Owner's personnel listing the date, subject covered, instructor's name, names of Owner's personnel attending, and the total hours given each individual.
- c) E/C shall report in person to Owner's operating engineer at end of first month of operation and thereafter at end of sixth and 12th months after date of substantial completion of building to check operation of equipment that was installed under contract. Contractor shall answer operating personnel's questions regarding system operation and shall ascertain that systems are operating normally and are being properly maintained by Owner. If E/C finds that systems are not being operated and maintained as designed, he shall inform the building engineer/Owner and A/E in writing.
- d) After each inspection, E/C shall submit written report to A/E indicating condition of equipment and including any recommended changes in operation of system or other information which will be helpful to Owner.

26-19 PRE-FINAL AND FINAL CONSTRUCTION REVIEW:

- a) At E/C's request, A/E will make pre-final construction review to determine if, to the best of their knowledge, project is completed in accordance with plans and specifications. Items found by A/E as not complete or not in accordance with requirements of contract will be outlined in report to E/C. After completion and/or correction of these items, E/C shall notify Architect project is ready for final review.

26-20 MAINTENANCE OF SYSTEMS:

- a) E/C shall be responsible for operation, maintenance, and lubrication of equipment installed under his contract.

26-21 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT:

- a) It shall be E/C's responsibility to protect and prevent damage to all electrical materials and equipment stored and/or installed under this contract. All work, materials, and equipment shall be adequately protected by any and all means necessary to prevent damage by weather, flooding, condensation, construction debris, fire, and construction equipment and vehicles.
- b) Equipment not rated for outdoor use shall be protected from moisture damage before and during construction. Covering equipment with a tarp on site is not considered a means of providing protection from moisture. Any equipment not rated for outdoor use exposed to moisture for any duration shall be replaced with new equipment at the contractor's expense.
- c) Where job conditions, or work of other contractors produce the potential for damage to electrical systems and equipment, E/C shall immediately notify the G/C so that corrective action can be taken.
- d) E/C shall take extra precautions to protect electrical equipment containing solid state electronics, open relays, and contacts from damage by water, dust, dirt, construction debris, and the formation of condensate. All equipment so damaged shall be replaced by E/C with new equipment at no cost to Owner.
- e) E/C shall periodically inspect and clean all systems and equipment to ensure all systems and equipment remain in like new condition during construction, free from dust and debris. All cleaning shall be done in accordance with E/M's recommendation where available and applicable.
- f) Before request for final inspection, all systems and equipment shall be properly cleaned, vacuumed, polished, painted, etc., as required to return equipment to like new appearance.
- g) All equipment requiring painting or touch-up shall be properly prepared and painted in accordance with this specification.
- h) All recessed floor boxes, poke-throughs and/or floor vaults shall be fully sealed and protected from moisture, dirt, construction debris and damage during and after installation. Provide protective covers for all equipment and follow all manufacturer's installation instructions. Install only the boxes and minimum support elements initially with final inserts, electrical components and electronics to be installed at final device installation as per the manufacturer's installation instructions. Where any moisture or debris does get into the wiring compartment(s) of recessed floor boxes, poke-throughs or vaults, it shall be the contractor's responsibility to replace all interior components at his expense. Where damage is done to the recessed box frames or tops, it shall be the contractor's responsibility to cut the damaged equipment out and replace with new (all patching and repair shall be the contractor's responsibility – coordinate with G/C). Notify A/E of all instances.
- i) E/C shall keep a written record listing systems and equipment cleaned. Where special procedures or chemicals were used or where partial or complete disassembly of factory assembled equipment was necessary, E/C shall list special procedures and/or disassembly required and equipment components affected. Prior to final inspection, E/C shall submit two (2) copies of cleaning record to A/E for their records.

26-22 PAINTING OF MATERIALS AND EQUIPMENT:

- a) Equipment and materials exposed to interior dry environment shall have a minimum of one (1) primer and one (1) finish coat. Equipment and materials mounted in exterior location shall have a minimum of one (1) primer and two (2) coat colors in finish areas shall be selected by A/E.

- b) After installation, damage to painted surfaces shall be properly prepared and primed with primers equal to factory materials. Finish coating shall be same color and type as factory finish.
- c) In all interior areas without finish ceilings, or where exposed conduit, junction boxes, hangers, supports, mounting brackets or device back-boxes are installed on walls, floors or exposed on finish ceilings, the contractor shall be responsible for painting all exposed materials to match building finishes. Refer to the Architect's specifications for additional requirements. Colors shall be as selected by Architect.
- d) Where extensive refinishing of factory applied finishes is required, equipment shall be completely repainted. A/E will make final determination of extent of refinishing required.

26-23 RECORDING AND REPORTING TESTS AND DATA:

- a) Record nameplate horsepower, amperes, volts, phase service factor, and other necessary data on motors and other electrical equipment furnished and/or connected under this contract.
- b) Record voltage and amperes-per-phase readings taken at service entrance equipment after completion of project with building operating at normal electrical load. This reading shall be taken continuously for a 24-hour period and recorded on permanent tape and submitted to A/E.
- c) Record voltage and amperes at transformer secondary and primary stations, at normal loading. Record transformer percentage "taps" finally selected. Transformers shall be connected to produce voltage at building service entrance equipment.
- d) Submit at least two (2) copies of data noted above to A/E for review prior to final inspection.
- e) Keep a record of all deviations made from routes, locations, circuiting, etc., shown on contract drawings. Prior to final inspection, submit one (1) new set of project drawings with all deviations and change clearly indicated.

26-24 IDENTIFICATION OF WIRING AND EQUIPMENT:

- a) Provide identification and warning signs to wiring and equipment as listed in schedule. Signs and tags shall be as follows:

TYPE 1	Laminated phenolic plastic with black Gothic-condensed lettering by Seaton or Wilco. Signs shall be weatherproof and securely attached to equipment.
TYPE 2	Self-sticking 0.5-inch-wide flexible nylon tape with high gloss surface and typed smear proof, chemical/solvent resistant lettering by Brady or Dymo.
TYPE 3	Self-sticking polyester sign with wording and size conforming to ANSI Z35.1 – 1964 and OSHA 19.0.144iii (2) specifications, by Brady or as approved.
TYPE 4	Self-sticking flexible vinyl with oil resistant adhesive for minus 20 deg F to 300 deg F temperatures by Brady or as approved.
- b) Provide distribution panelboards with Type 1 signs 2 inches by 8 inches indicating panel designation, electrical characteristics and source of power. Source of power indication shall indicate source panel designation and switch or breaker number. Provide branch devices with Type 1 sign 1 inch by 4 inches indicating load served.
- c) Provide lighting and power panelboards with Type 1 sign 1.25 inches by 6 inches indicating panel designation, electrical characteristics, and source of power. Source of power indication shall indicate source panel designation and switch or breaker number.
- d) Provide disconnect switches, time switches, lighting contactors, motor starters, and controllers with Type 1 sign 1.25 inches by 6 inches indicating equipment served, electrical characteristics, and source of power. Source of power indication shall indicate source panel designation and switch or breaker number.

- e) Provide electrical equipment and accessible wiring enclosures (junction boxes included) operating at voltage above 240 volts with Type 3 Brady No. AE-461 25 warning sign and Brady Style B, 1.125 inches by 4.5 inches voltage marker applied to front door or cover of device or enclosure. Provide large equipment such as transformers and main distribution equipment with Type 3 sign Brady No. AE-46639.
- f) Provide feeders and branch circuit home runs with Type 4 wire marker indicating circuit number and power source. Provide feeders phase identification letter at each terminal point in addition to its circuit number.
- g) Provide Type 2 tape at feeder terminal lugs to switchboards and panelboards. Tape shall indicate conduit size, conductor type, and AWG size. Tape shall be located to be easily read with conductors installed.
- h) All electrical equipment, such as switchboards, panelboards, distribution panelboards, load centers, industrial control panels, meter socket enclosures, C/T cabinets and motor control centers shall be provided with a Type 1 sign warning persons of potential electric arc fault hazards. The sign shall be located so as to be clearly visible to qualified persons before examination, adjustment, servicing or maintenance of the equipment. Sign shall include at a minimum the orange 'WARNING' label with exclamation point symbol, and the wording "ARC FAULT HAZARD. APPROPRIATE PPE REQUIRED. FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY. REFER TO NFPA 70E."
- i) All electrical equipment, such as switchboards, panelboards, distribution panelboards, load centers, industrial control panels, meter socket enclosures, C/T cabinets, motor control centers and disconnect switches shall be provided with a Type 1 sign indicating the maximum available fault current. The sign shall include the date at which the calculation was performed. This sign shall be separate from other required signs so that it is more easily replaced in the future when changes are made.

26-25 SLEEVES:

- a) Provide proper type and size sleeves for electrical ducts, busses, conduits, etc., passing through building construction. Where sleeves are installed by others, supervise installation to ensure proper sleeve location. Unless indicated or approved, install no sleeves in structural members. Sleeves shall be installed in concrete or masonry walls or floors and where otherwise noted.
- b) Each sleeve shall be continuous through wall floor or roof and shall be cut flush on each side except where indicated otherwise. Sleeves shall not be installed in structural member except where indicated or approved. Sleeves shall be required through floors subject to flooding such as toilet rooms, equipment rooms, and kitchens. The contractor shall have the option of:
 1. Providing a PVC sleeve with integral flanges extending 1-inch above finished floor. Sleeve shall be cast in concrete when floor is poured. Annular space between sleeve and pipe shall be filled with Kawool. This option can only be used where sleeve does not communicate with supply or return air plenum.
 - or
 2. Provide core-drilled opening in concrete with ThunderlineUnk-Seal or Calpico Sealing Linx between piping and opening.
- c) Sleeves passing through floors and exterior walls with waterproof membranes shall be core-drilled (floors only) and sealed with Thunderline Link-Seal or Calpico Sealing Linx.
- d) Where electrical ducts, busses, conduits, wiring, etc., pass through fire walls, floors, and smoke partitions, seal annular space between sleeve and item passing through with Kaowool Fire Master Bulk Packing. Packing thickness shall be sized per manufacturer's recommendation for maintaining the integrity of the fire wall/floor or smoke partition. Fire protection system shall be rated per ASTM E 119. Equivalent to Kaowool are 3M, Flame stop, or Flame Safe.

- e) Where piping passes through walls serving as supply or exhaust air plenums or chases, seal annular space between pipe and sleeve air tight with Thunderline Link-Seal or Calpico Sealing Linx.

26-26 RECORD DOCUMENTS:

- a) Record Drawings: Maintain a reproducible set of contract drawings and shop drawings in clean, undamaged condition, with mark-up of actual installations which vary substantially from the work as originally shown. Mark whichever drawing is most capable of showing "field" condition fully and accurately; however, where shop drawings are used for mark-up, record a cross-reference at corresponding location on working drawings. Mark with red erasable red pencil and, where feasible, use other colors to distinguish between variations in separate categories of work. Mark-up new information which is recognized to be of importance to Owner, but was for some reason not shown on either contract drawings or shop drawings. Give particular attention to concealed work, which would be difficult to measure and record at a later date. Note related change order numbers where applicable. Organize record drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on cover of each sheet.
- b) The Contractor shall provide a full set of photographs showing the entire underground equipment. The photographs shall be taken prior to any concrete being poured. The underground equipment shall consist of, but not be limited to, conduits, floor boxes, etc.
- c) The Contractor shall provide the photographs in an 8.5-inch by 11-inch format for record keeping purposes with the maintenance manuals. The photos shall all be digital and a flash drive or CD shall be provided to the Owner as a permanent record.
- d) As-built documents shall be submitted for approval prior to final payment. Copies of "in-progress" as-built drawings shall be submitted at each pay request.

26-27 CIRCUITING:

- a) Follow circuiting shown on drawings for lighting, power, and equipment connections.
- b) Shared neutrals are not allowed for any circuits fed through a dimming system.

26-28 CONDUIT APPLICATION:

- a) All wiring shall be in steel conduit unless otherwise noted in this section.
- b) Provide EMT conduit for the following applications:
 - 1. All panelboard feeders above grade.
 - 2. All branch circuit homeruns.
- c) Non-metallic conduit shall be allowed only for the following applications:
 - 1. Electrical service feeders below grade. Transition to steel conduit shall be made prior to coming up from below grade.
 - 2. Branch circuits below grade. Transition to steel conduit shall be made prior to coming up from inside the concrete.
 - 3. Underground communication service.
- d) MC Cable shall be allowed for the following applications only (all homeruns shall be in EMT conduit):
 - 1. Light fixture whips (maximum of 6').

- e) Where MC cable is noted above as allowed, it shall be installed as follows:
1. MC cable shall be allowed for light fixture whips. EMT is required from between fixtures.
- f) Minimum homerun conduit size shall be 0.75"
- g) All low voltage wiring systems (including, but not limited to temperature controls, security, access control, telephone/data, television, audio/video, fire alarm, lighting control, etc.) shall be provided with junction boxes and conduit up to above accessible lay-in ceilings, where open, plenum-rated wiring is allowed only above lay-in and/or sheetrock ceilings where wiring will be concealed from view. Where there is no ceiling (exposed structure), conduits shall be provided to conceal all wiring and all conduits shall be concealed in the building construction – exposed conduits are not allowed anywhere on the project. Temperature control wiring, security, access control, telephone/data, television, audio/video, fire alarm, lighting control, etc. wiring shall be bundled together by system and supported from the structure at regular intervals with J-hooks and additionally as required by code and the manufacturer where routed as open wiring above ceilings. Wiring shall not be routed unsupported or with straps. Fire alarm wiring shall be allowed to be open wiring as allowed by the National Electric Code above areas with lay-in or sheetrock ceilings. Provide conduit for all fire alarm wiring in all mechanical/electrical rooms, janitor's closets and storage/electrical rooms. NO exposed wiring will be allowed in any public accessible spaces – coordinate with exposed structural areas.
- h) All feeders feeding the fire pumps shall be embedded in 2" minimum of concrete all the way around the conduit. Where not embedded in concrete, feeders shall be protected by a fire-rated assembly listed to achieve a minimum fire rating of 2-hour. Concrete encasement and/or the 2-hour fire-rated assembly are the responsibility of the electrical contractor – coordinate with the G/C to include all costs in the base bid per NEC.

26-29 STEEL CONDUIT:

- a) Rigid Conduit: Provide steel conduit meeting current ANSI C80.1 with hot-dipped galvanized and clear lacquer finish.
- b) Electrical Metallic Tubing (EMT): Provide thinwall conduit meeting current ANSI C80.3 with electro-galvanized and clear lacquer finish.
- c) Rigid Conduit and EMT Fittings: Provide Appleton Form 35 non-thread malleable iron unilets. Equivalent by CrouseHinds or Pyle National.
- d) Rigid Conduit Connectors and Couplings: Provide steel NO-THREAD-TYPE. Rain and concrete tight shall be used for exterior or below grade applications. Equivalent by Thomas and Betts, Appleton, O-Z Gedney, Raco, Crouse Hinds, or Steel City.
- e) EMT Connectors and Couplings: Provide insulated COMPRESSION EMT TYPE. Provide insulated, concrete tight and rain tight where required for application. Equivalent by Thomas and Betts, Appleton, O-Z Gedney, Raco, Crouse Hinds, or Steel City.
- f) Liquid-Tight Flexible Conduit Fittings: Appleton "STB" series insulated connectors. Equivalent by Raco, Thomas and Betts, or Crouse Hinds.
- g) Provide insulated throat fittings when Type THHN/THWN conductors are installed.
- h) Short runs of flexible galvanized steel conduit may be used where permitted by code. Lengths greater than 6 feet require review by Engineer.
- i) Make conduit connections to motors and equipment mounted on resilient mounts or vibration isolators with Type U.A. liquid-tight flexible conduit manufactured by Anaconda, or "Liquatite" by Electric-Flex Company.

26-30 PLASTIC CONDUIT:

- a) The following are general requirements for installation of plastic conduit which apply only where such plastic conduit is specifically allowed by applicable section in Division 26.
- b) Normal duty applications in concrete slabs or underground without concrete encasement. Conduit shall be CarlonPlus 40 or Carlon Plus 80, rated for use with 90 deg C conductors, UL Listed or approved equal. Material shall comply with NEMA TC-2 (conduit), TC-3 (fittings) and UL 651 (conduit) and UL514B (fittings). Conduit shall be listed UL 651 for underground and exposed use.
- c) All conduit and fittings shall be solvent cemented in applications in accordance with instructions from the manufacturer.
- d) Normal duty exterior underground applications direct burial: Provide semi-rigid polyvinyl chloride (PVC) Type DB plastic duct meeting current NEMA TC-6 and Western Underground Committee Specifications.
- e) Normal exterior underground applications encased burial: Provide semi-rigid polyvinyl chloride (PVC) Type A plastic conduit meeting current NEMA and Western Underground Committee Specifications.
- f) Provide matching plastic conduit fittings by E/M. Fittings shall meet the same standards and specifications as the conduit on which it is installed.
- g) Joining and bending of conduit and installation of fittings shall be done only by methods recommended by E/M.
- h) Provide conduit support spacing as recommended by E/M for the highest ambient temperature expected.
- i) Provide interlocking conduit spacers by E/M or multiple runs of underground conduits installed in the same trench.
- j) Ends of feeder conduit terminating at transformers, switchgear, manholes, etc., shall be terminated with bell ends to protect conductor insulation.
- k) Install no plastic conduit in areas where ambient temperature may exceed 150 deg F under normal conditions nor on heat producing equipment such as boilers, incinerators, etc. Install no plastic conduit in a return air or supply air plenum for the HVAC systems.
- l) Provide expansion couplings on conduits located in areas where ambient temperatures are constantly changing and on long runs regardless of ambient temperatures. Determine amount of conduit expansion and contraction from E/M's published charts or tables.
- m) All below grade PVC conduit shall be provided with tracer wire.
- n) Plastic conduit and fittings shall be by Carlon, Allied, ABB or equal.

26-31 CONDUIT INSTALLATION:

- a) In general, conceal conduit within walls, floors, roof construction, or furred spaces. Expose only feeders and short connections to equipment in equipment rooms unless noted otherwise. Install exposed conduit parallel or at right angles to building lines.
- b) Install conduit to requirements of structure, other work on project and clear of openings, depressions, pipes, ducts, reinforcing steel, etc. Install conduit in concrete forms so that strength of structure will not be affected.

- c) Align conduit terminations at panelboard, switchboards, motor control equipment, junction boxes, etc., and install true and plumb. Provide supports or templates to hold conduit alignment during rough-in stage of work.
- d) Install conduit continuous between outlet boxes, cabinets, and equipment. Make bends smooth and even without flattening or flaking conduits. Radius of bends shall not be shorter than radius listed in NEC chapter 9, table 2. Long radius elbows may be used where necessary.
- e) Ream and clean conduit before installation and plug or cover openings and boxes to keep conduit clean during construction.
- f) Install no conduits or other raceways sized smaller than permitted in applicable NEC tables. Where conduit sizes shown on drawings are smaller than permitted by code, E/C shall include cost for proper size conduit in his base bid. In no case reduce conduit sizes indicated on drawings or specified without written approval of A/E. Fasten conduit securely in place with approved straps, hangers, and steel supports. Provide O-Z cable support to support conductors in vertical raceways as required by NEC Table 300-1 9(a). Where special hangers are required, submit hanger details to A/E for review before installation.
- g) Where conduits cross expansion joints in building construction, the conduit system shall be provided with a means of allowing expansion/contraction in the conduit system.
- h) Where a conduit or conduits enter a building from underground or from the exterior, they shall be sealed in accordance with the NEC section 300.5(G). Spare or unused conduits shall also be sealed. Sealants shall be identified for use with the cable insulation, shield or other components. Conduits (or sleeves) which will be subjected to different temperatures (such as where passing from interior to exterior, or at coolers/freezers, etc.), the conduit (or sleeve) shall be filled with an approved material to prevent the circulation of warm air to a colder section.

26-32 INSERTS AND HANGERS:

- a) Support vertical and horizontal conduit runs at intervals not greater than 10 feet, within 3 feet of any bend and at every outlet or junction box, where plastic conduit is used follow E/M's recommended hanger spacing.
- b) Insert multiple runs of conduits as follows:
 1. Where a number of conduits are to be run exposed and parallel, group and support trapeze hangers.
 2. Fasten hanger rods to structural steel members with suitable beam clamps and to concrete structures with inserts set flush with surface. Install concrete inserts with reinforced rod through opening provided in inserts.
 3. Inserts shall be Grinnell Figure 279, 281, 282, or 285 or equivalent as required by load and concrete thickness.
 4. Provide beam clamps suitable for structural members and conditions.
 5. Provide 0.375-inch minimum diameter steel hanger rods galvanized or cadmium-plated finish.
 6. Trapeze hangers shall be Kindorf Series 90 channel with fittings and accessories as required.
 7. Attach each conduit to trapeze hanger with Steel City No. C01 05 clamps for rigid conduit and Steel City No. C-1 06 clamps for EMT.
- c) Install clamps for single conduit runs as follows:

1. Support individual runs by approved pipe straps, secured by approved pipe straps, secured by toggle bolts on hollow masonry; expansion shields and machine screws or standard preset inserts on concrete or solid masonry; machine screws or bolts on metal surfaces; and wood screws on wood construction. Use of perforated strap not permitted.
 2. Install exposed conduits in damp locations with clamp backs under each conduit clamp to prevent accumulation of moisture around conduits.
 3. Individual conduits suspended from ceiling shall be supported by Steel City No. C-1 49 hangers.
- d) Provide inserts, hangers, and accessories with finish as follows:
1. Galvanized: Concrete inserts and pipe straps.
 2. Galvanized or Cadmium Plated: Steel bolts, nuts, washers, and screws.
 3. Painted with Prime Coat: Individual hangers, trapeze hangers, and rods.
- e) Equivalent hanger and support systems by Grinnell, Fee and Mason, B-Line, Caddy, or Unistrut.
- f) Supports and/or support wires for electrical equipment, raceways, light fixtures, etc. shall be designated (painting is acceptable) separately from supports and/or support wires for other building systems. All supports and/or support wires shall be designated the same throughout the project.

26-33 BUSHINGS AND LOCKNUTS:

- a) Enter outlet boxes squarely and securely clamp conduit to outlet box with bushing on inside and locknut on outside. Provide Steel City BG series or equivalent threaded die-cast zinc insulated throat grounding bushings.
- b) Terminate metallic conduits at switchboards, panelboards, control cabinet, etc., with Steel City BG series or equivalent malleable iron grounding type insulation bushings. Ground bushings to equipment grounding bus.

26-34 OUTLET BOXES:

- a) Provide electrical service outlets, including plug receptacles, lamp receptacles, lighting fixtures, and switches with Steel City, Raco, or equivalent 4-inch code gauge steel knockout boxes galvanized or sheradized of required depth for service or device.
- b) Provide code gauge galvanized steel raised covers on outlet boxes installed in plaster finish. Set to plaster grounds with outside edge of cover flush with plaster finish.
- c) Provide 0.375-inch or larger fixture stud in each outlet box scheduled to receive lighting fixture. Select covers with proper opening for device installed in outlet box.
- d) Use of utility or "Handy" boxes acceptable only where single gang flush outlet box in masonry is "dead-end" with only one conduit entering box from end or back.
- e) Use no sectional outlet boxes.
- f) Provide Appleton FS or FD unilets for surface mounted exterior work. Provide complete with proper device cover and gasket. Provide blank cover and gasket when used as junction box.
- g) Install boxes to maintain all fire ratings, as required by the building code and NEC. At all boxes installed in fire walls throughout the project, provide fire-rated sealing assembly (refer to the other specification sections for additional locations – refer to the architectural specifications for specification of all fire-rated

penetration sealing materials and/or assemblies). Putty pads and/or other fire-rated sealing assemblies, where provided, shall fully seal all boxes and conduit entries (including at the penetration into the top of the wall) and shall be installed per the manufacturer's instructions (including minimum/maximum ambient temperatures at time of install and after installation). Submit fire penetration materials and information with the shop drawings to the architect. Refer to the other specification sections for additional requirements. Putty pads and/or fire-rated sealing assemblies shall have a minimum STC rating per the architectural specifications.

- h) For telephone, data or A/V junction boxes, provide the Hubbell HBL260 or HBL263 large capacity wall-boxes for all outlets. Provide complete with necessary mud-rings and components for a complete installation. Refer to plan notes for any additional requirements.

26-35 LOCATION OF OUTLET BOXES:

- a) Locate outlet boxes generally from column centers and finished wall lines. Install ceiling outlet boxes at suspended ceiling elevations.
- b) Accurately locate lighting fixtures and appliance outlet boxes mounted in concrete or in plaster finish on concrete. Install outlet boxes in forms to dimensions taken from bench marks, columns, walls, or floors. Rough-in lighting fixtures and appliance outlet boxes to general locations before installation of walls and furring, and reset to exact dimensions as walls and furring are constructed. Set outlet boxes true to horizontal and vertical finish lines of building.
- c) Install outlet boxes accessible. Provide outlet boxes above piping or ductwork with extension stems or offsets as required to clear piping and ductwork.
- d) Install light switch or lighting control junction boxes at 48 inches above floor to the top of the box unless otherwise called for or required by Wainscot, counter, moulding, etc – coordinate with millwork contractor and G/C prior to any rough-in. All electrical light switches shall be located as close to door frame as possible. Under no circumstances should switches be located more than 12 inches from the edge of door frames.
- e) Install centerline receptacle outlet boxes 18 inches above floor unless otherwise called for on drawings.
- f) All thermostats, temperature sensors and HVAC controls shall be installed at 48" above finish floor to the top of the thermostat or sensor, on the room side of light switches where shown in the same location. None of the controls shall be higher than 48" above finish floor to the operating or visible parts.
- g) Maintain minimum clearances for all boxes for proper operation of equipment (including, but not limited to, switches, fire alarm devices, temperature controls, lighting controls, receptacles, television outlets, telephone/data outlets, volume controls, A/V controls, screen switches, etc.) after they are installed – coordinate installation requirements with M/C, temperature controls contractor, owner's A/V contractor, lighting control manufacturer and owner's telephone/data and television system contractors prior to any rough-in to allow adequate space for all equipment. Where conflicts occur with other building components (or with light switches below these devices), notify A/E of conflict and get approval to modify box location, height or rotation prior to any rough-in. It shall be the contractor's responsibility to relocate any boxes, conduits, wiring, etc. installed prior to coordination with any other building system.
- h) If a wiring device (including, but not limited to, switches, fire alarm devices, temperature controls, lighting controls, receptacles, television outlets, telephone/data outlets, volume controls, A/V controls, screen switches, etc.) is shown to be installed in or on a column, it shall be centered on the column unless noted otherwise.
- i) Locate associated data, telephone and television outlets at the same height as adjacent, associated receptacles, within 6 inches of the associated receptacles, where shown side-by-side on the plans and not noted otherwise.

- j) Where wall-mounted telephone outlets are shown on the drawings in the same location as light switches, the telephone outlet shall be installed to the room side of the light switches at 48" above finish floor to the top of the telephone controls (no part of the telephone controls shall be higher than 48" above finish floor. Coordinate phone requirements with the owner prior to any rough-in). Do not locate phone outlet above the switches – locate 8" from the end of the light switches to allow clearance of the phone.
- k) Where wall-mounted volume controls, A/V controls, and/or screen switches are shown on the drawings in the same location as light switches, these controls shall be installed on the room side of light switches at 48" to the top of the box.
- l) Contractor shall be responsible for coordination of all box locations with millwork, wall treatments (mats, chair rails, paneling, special systems, etc.), finishes and architectural elements to maintain full accessibility per NEC and to facilitate installation and operation of all systems. Where conflicts occur with other building components, notify A/E of conflict and get approval to modify box location or rotation prior to any rough-in. It shall be the contractor's responsibility to relocate any boxes, conduits, wiring, etc. installed prior to coordination with any other building system.
- m) Install clock and other outlet boxes at elevations indicated on drawings or as directed by A/E. Center bracket lights over mirrors with 2-inch clearance above the mirror to the bottom of the installed fixture.
- n) Provide Alwalt, Keystone, Universal, or equivalent code gauge pull boxes, wireways, and gutters indicated or required for installation, sized to conform to NEC rules. Provide complete with necessary fittings, interconnecting nipples, insulating bushings, conductor supports, covers, gaskets, partitions, etc., as required.
- o) Special items may be fabricated locally to same general design and specifications as those listed in specified manufacturer's catalogs. Provide free of burrs, sharp edges, unreamed holes, sharp pointed screws or bolts, and finished with one coat of suitable enamel inside and out, prior to mounting.
- p) Where devices are installed in masonry, coordinate with A/E prior to any rough-in to allow adjustments for masonry joint locations.

26-36 PULL BOXES, WIREWAYS, AND GUTTERS:

- a) Provide Alwalt, Keystone, Universal, or equivalent code gauge pull boxes, wireways, and gutters indicated or required for installation, sized to conform with NEC rules. Provide complete with necessary fittings, interconnecting nipples, insulating bushings, conductor supports, covers, gaskets, partitions, etc., as required.
- b) Special items may be fabricated locally to same general design and specifications as those listed in specified manufacturer's catalogs. Provide free of burrs, sharp edges, unreamed holes, sharp pointed screws or bolts, and finished with one coat of suitable enamel inside and out, prior to mounting.
- c) Provide sectional covers for easy removal.

26-37 CONDUCTORS:

- a) Unless noted otherwise conductors referred to are wires and cable. Provide code grade soft annealed copper conductors with specified insulation type in proper colors to conform to color coding specified. Provide conductors No. 8 gauge and larger stranded and conductors No. 10 gauge and smaller shall be solid.
- b) Use no conductors smaller than No. 12 gauge unless specifically called for or approved by D/E. Size wire for 120 volt branch circuits for 3 percent maximum voltage drop. Size feeder circuits for 2 percent maximum voltage drop. Combined voltage drop of feeders and branch circuits shall not exceed 5 percent maximum.

- c) Provide conductors for listed applications as follows:
 1. Lighting and Receptacle Circuits: Type THHN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.
 2. Power Circuits and Feeders: Type THHN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.
 3. Low Voltage and Line Voltage Conductors Sizes No. 16 and No. 18 AWG: Type TFFN, 600 volt, 90 deg C (194 deg F) thermoplastic insulated building conductor.
 4. Underground Circuits and Feeders: Type THHN/TWHN, 600 volt, 75 deg C (167 deg F) wet rating and 90 deg C (194 deg F) dry rated thermosetting filled insulating cable.
- d) Provide conductors by Encore Wire and Cable, Southwire, Senator Wire and Cable, and Cerro Wire or equivalent.

26-38 CONDUCTOR INSTALLATION:

- a) Run conductors in conduit continuous between outlets and junction boxes with no splices or taps pulled into conduits.
- b) Neatly route, tie, and support conductors terminating at switchboards, motor control centers, panelboards, sound equipment, etc., with Thomas & Betts Ty-Rap cable ties and clamps or equivalent by Electrovert or Panduit.
- c) Make circuit conductor splices with Buchanan B- Cap nylon insulated connectors or equivalent by Ideal or 3M.
- d) Make fixture and device taps with Scotchlock self-stripping electrical tap connectors.
- e) Terminate solid conductors at equipment terminal strips and other similar terminal points with insulated solderless terminal connectors. Terminate all stranded conductor terminal points with insulated solderless terminal connectors. Provide Thomas & Betts Sa-Kon insulated terminals and connectors or equivalent by API/AMP Blackburn, Buchanan, or Scotchlock.
- f) Where a total of six (6) or more control and feeder conductors terminate in a multiple device panel or enclosure that has no built-in terminal blocks, provide mounting channel and see-through covers. Equivalent terminal blocks by General Electric, Square D, or approved equal.
- g) Wrap conductor taps and connections requiring additional insulation with a minimum of three (3) overlapped layers of 3M Scotch vinyl plastic electrical tape No. 88 or equivalent.

26-39 CONDUCTOR COLOR CODING:

- a) Provide continuous color coding for feeder, branch, and control circuits. Insulation or identification tape color shall be same color for like circuits throughout. Where specified insulation colors are not available in larger wire sizes, color code conductor at all accessible locations with Scotch 35 all-weather color code tape.
- b) Identify the same phase conductor with same color throughout.
- c) Provide conductors with color coding indicated. Where more than one standard voltage system is installed, provide same-colored conductors with indicated tape or stripe to indicate system voltage.

SYSTEM VOLTAGE	CIRCUIT	INSULATION COLOR	STRIPE COLOR
277/480	Neutral	White	Orange

SYSTEM VOLTAGE	CIRCUIT	INSULATION COLOR	STRIPE COLOR
277/480	Phase A	Brown	--
277/480	Phase B	Orange	--
277/480	Phase C	Yellow	--
120/208	Neutral	White	--
120/208	Phase A	Black	--
120/208	Phase B	Red	--
120/208	Phase C	Blue	--
277/480	Switch	Same as Ph. Color	White
120/208	Switch	Same as Phs. Color	White
277/480	3-Way Sw Runner	Purple	Orange
120/208	3-Way Sw Runner	Purple	--
120/208	Control	Pink	--
277/480	Equip. Ground	Green	Yellow
120/208	Equip. Ground	Green	--

26-40 FUSES:

- a) Provide fuses of same manufacturer and characteristics as scheduled to insure selective coordination of power system. Fuses shall be Bussmann or equivalent by Mersen, Bussmann, Littelfuse, or Brush.
- b) Install fuses only after installation is complete and final tests and inspections have been made. Label fuses, switches, and other fused devices with warning labels affixed in prominent location indicating type and size of fuse installed and fuse manufacturer's catalog number. Labels are supplied in fuse cartons.
- c) Furnish Owner with spare fuses of each size and type installed on job as follows:

601 Amps or larger	Three (3) of each size and type.
600 Amps or less	10% with minimum of three (3) of each size and type.
- d) Obtain receipt from Owner's representative showing date, quantity, and size of spare fuses delivered to Owner. Submit two (2) copies of receipt to A/E and bind one (1) copy in Owner's shop drawing manual.
- e) Provide fuses with casings to match fuse holder dimensions. Fuse reducers shall not be used without prior approval of D/E.
- f) Fuse shop drawings shall contain a schedule listing fuse type and size to be provided in each switch or fuse block. Also, provide a list indicating type, size, and quantity of spare fuses to be provided to Owner.
- g) Fuse types shown in equipment schedules are Bussmann type designations unless otherwise indicated.

26-41 SAFETY SWITCHES:

- a) Provide heavy duty and general duty horsepower rated safety switches rated in accordance with NEMA enclosed Switch Standard KS1 and UL 98 and as scheduled.
- b) Enclosure shall be NEMA type required by switch location and environment. Enclosure door shall have latch with means for padlocking and cover interlock with defeater to prevent opening door when switch is energized or closing switch with door open. Switch shall have an embossed nameplate permanently attached to door front with switch rating, short circuit interrupting capacity, and application information.

- c) Line terminals shall be permanently marked and shielded. Contacts shall be tin plated, equipped with arc chutes, and have moving contacts visible in off-position with door open. Wiring terminals shall be pressure type suitable for copper or aluminum wire. Switching mechanism shall be quick-make, quick-break, spring driven, anti-tease mechanism, and be integral part of box. All current carrying parts shall be plated.
- d) Fuse holders for 1 to 600 amperes shall be high pressure type for use with Class R current limiting fuses. Fuse holders shall be completely accessible from front of switch.
- e) Provide switches by Eaton/Cutler-Hammer, General Electric, ITE/Siemens, or Square D.
- f) See schedule.

26-42 LIGHTING CONTACTORS:

- a) Provide 600 volt, 60 cycle mechanically or electrically held lighting contactors with proper NEMA enclosure required by contactor location and environment.
- b) Contactors shall have silver alloy, double break power contacts replaceable without removing power wiring or contactor from enclosure.
- c) Coils shall be molded case construction permanently marked with coil voltage and frequency and be replaceable without removing contactor from enclosure.
- d) Provide contactor with internal wiring and control circuits prewired with only line, load, and external control circuits wiring connections required. Provide contactor with built-in clearing interlocks to allow control from either momentary or maintained pilot devices.
- e) Contactor shall be suitable for addition of at least two (2) electrical interlocks of any arrangement of normally open or closed contacts.
- f) Provide contactor with accessories such as auxiliary contacts, pilot lights, on-off, or HOA switches required to obtain control sequence shown on plans or specified. Accessories shall be available as kits for field installation or modification.
- g) Where three (3) or more contactors are installed at one location, contactors may be installed in group control panel in lieu of separate devices.
- h) Contactors by Allen-Bradley, Eaton/Cutler-Hammer, ITE/Siemens, Square D, or General Electric.
- i) See schedule.

26-43 WALL SWITCHES:

- a) Provide Leviton switches with compound handles compliant with FS W-S-896 and UL20. Install groups of switches under one (1) coverplate.
- b) Provide switches in colors as selection by A/E.
- c) Switches controlling loads of 1800 watts or less shall be as follows unless specified otherwise:

TYPE	CATALOG #	AMP	VOLTAGE
Single Pole	LE 1221-2	20	120/277
Three Way	LE 1223-2	20	120/277
Four Way	LE 1224-2	20	120/277
Pilot Light	LE 1221-PL	20	120/277
Momentary Contact	LE 1257	20	120/277

TYPE	CATALOG #	AMP	VOLTAGE
Double Pole	LE 1222-2	20	120/277
Occupancy	HU AD2000(1/2)	20	120/277
Occupancy/Dimmer	HU LHD-IRS-3	20	120/277

d) Weatherproof switch shall have Leviton Gray coverplate and press-switch combination as follows:

TYPE	CATALOG #	AMP	VOLTAGE
Single Pole	LE 1432	15	120

e) Mount weatherproof switches in proper size FS box.

f) Where switches are shown side-by-side in the same location, or shown in the same location on the lighting and power plans separately, gang all switches together in the same box with a single coverplate (whether detailed specifically on the drawings, or not).

g) Where wall dimmers are indicated, provide on/off with slide dimmer switch, rated for the load and load type served. Follow the manufacturer's requirements. Color of switch and coverplate shall match other wiring devices.

h) Equivalent switches by Cooper Wiring, Hubbell, Pass & Seymour, Bryant, Lutron or Leviton.

i) Electric timer switches shall be Leviton Model LTB30-1LZ or Watt Stopper Model TS-200 in color to match other wiring devices.

26-44 RECEPTACLES:

a) Provide Leviton specification grade NEMA WD-1 – 1974 grounding receptacles with color as selected by A/E (Isolated ground receptacles shall be white in color with green triangle designation; receptacles wired on circuits fed by the emergency generator shall be red in color where labeled on the contract documents):

TYPE	NEMA	CAT. #	AMP	VOLTAGE
Duplex	5-20R	LE 5352	20	125
Dual Voltage	5-20R/6-20R	LE 5842	20	125/250
Ground Fault	5-20R	LE 6899-A	20	125
Isolated Ground	5-20R	LE 5363-IG	20	125
GFI/TR	5-20R	LE G5362	20	125
Tamper Resistant	5-20R	LE 5362-SG	20	125
USB	5-20R	LE T5832	20	125
Weather Resistant	5-20R	LE TWR20	20	125

b) Provide weatherproof, tamper resistant receptacles with weatherproof boxes and covers as follows:

c) Install device in Hubbell Taymac MX5280S series gray "While-In-Use" cover for weatherproof in use (WPI).

d) Provide Wiremold Plugmold 2000 multi-outlet system in series as follows:

TYPE	SERIES	DESCRIPTION
1	GB	3-wire, 1-circuit; insulated grounding conductor.
2	GB2	4-wire, 2-circuit; outlets wired alternately; insulated grounding conductor.
3	DGB	3-wire, 1-circuit; duplex outlets; insulating grounding conductor.
4	IG	3-wire, 1-circuit; insulated-isolated grounding conductor.

1. Outlet spacing and length shall be as indicated on drawings.

- e) Provide recessed wall boxes for all wall mounted television/monitor locations. Wall box shall be 2-gang and shall include duplex receptacle and data connection equal to Legrand TV2MW or Hubbell Flat Panel Connection Enclosure.
- f) Equivalent receptacles by Cooper Wiring, Hubbell, Bryant, Leviton, or Pass & Seymour.
- g) Provide Leviton grounding receptacles as follows:

TYPE	NEMA	CAT. #	AMP	VOLTAGE
Combination	10-30	LE 278	30	125/250
Combination	10-50	LE 279	50	125/250

- h) GFCI receptacles, where indicated or required by code, shall be installed in accessible locations. They shall not be installed concealed behind equipment, in attics, above ceilings, inside electric water cooler housings, etc... Where a GFCI receptacle is shown on the drawings where it may be concealed, the contractor shall provide a GFCI circuit breaker in the panel.

26-45 FLOOR BOXES:

- a) Refer to the drawings for specific floor box specifications and fire rating requirements. Provide all floor boxes with accessories and covers for a complete installation, compatible with the floor finish and type in which they are installed. Provide finish plates for all wiring devices indicated. Provide cast iron boxes, or boxes with epoxy coating for any boxes shown installed in slab-on-grade installations – boxes shall be UL listed for slab-on-grade installation. All floor boxes shall be UL listed for scrub water penetration. Include any required dividers as required to isolate power and communication compartments when devices are indicated side by side on plans.
- b) Where floor boxes are shown but not specifically noted on the drawings, provide concealed service floor boxes with duplex receptacles and communication and data communication brackets as indicated on drawings. Provide gangs as necessary to accommodate the devices and quantity of devices indicated on the plans. Provide all inserts as necessary for the devices indicated and for a complete installation without leaving any unused openings. Where there are spare unused spaces in floor boxes provide blanks for all unused sections.
- c) Plastic or PVC floor boxes are not approved.
- d) Floor boxes shall be Wiremold model RFB-4 and/or RFB-6 recessed box with aluminum cover with tile/carpet inlay (as applicable) for concealed service box. Boxes shall be Legrand Evolution or Hubbell System One for recessed service box with flush universal cover. Provide poke through type for all multi-floor applications. Covers shall be aluminum finish unless indicated otherwise.
- e) Equivalent floor boxes by Wiremold/Legrand, Steel City and Hubbell.
- f) For installation location of floor boxes, Contractor shall refer to Architectural plans for associated furniture locations and floor system type.

26-46 FLUSH WALLPLATES:

- a) Provide Leviton high-impact nylon wallplates conforming to UL, NEMA and Federal Specification WP-455A.
- b) Provide wallplates for all switches, receptacles, blanks, telephone, computer, and special purpose outlets.

- c) Plates shall be modern design, having rounded edges and corners complete with finish-matching mounting screws.
- d) Provide flush wallplates on wiremold switch and receptacle boxes.
- e) Provide factory engraved wallplates where indicated. Where engraved text is not outlined, submit two (2) copies of proposed text to A/E for review and approval prior to engraving.
- f) Wallplates shall not support wiring devices. Provide wiring device accessories as required to properly install devices and wallplates.
- g) Provide wallplates of one design throughout the building.
- h) Provide designs and finishes equivalent to above specification where wallplates for special devices are available only from manufacturer of device.
- i) Verify with A/E finish of any plate where it may be apparent a special finish or color should have been specified.
- j) Provide narrow wallplates as indicated.
- k) Ganged wiring devices shall have a single wallplate.
- l) Provide wallplates manufactured by same company as wiring devices.

26-47 LIGHTING FIXTURES:

- a) Provide fixtures complete with lamps and accessories required for hanging. E/C shall ensure that lamps, reflectors, lens, and trim are clean at time of final inspection. Mount recessed fixtures with trim flush to ceilings, free of gaps or cracks.
- b) Coordinate mounting of ceiling mounted lighting fixtures with G/C. Where additional ceiling or fixture supports are required due to fixture location or weight they shall be provided by E/C, unless otherwise specified under ceiling specifications.
- c) Fixture lamps shall be lamp type recommended by E/M. Lamp no fixtures above E/M's recommended maximum wattages.
- d) Consult Architectural plans for ceiling types and provide recessed fixtures and mounting components accordingly. All light fixture installation in fire rated ceilings shall comply with UL listing for rated assembly. Fixture model number shown in the schedule may not reflect correct ceiling mounting requirements – E/C shall verify with A/E prior to ordering any fixtures and include all costs in the base bid.
- e) Fixture supports shall comply with NEC 410-30 and 410-36. Provide fixture securing clips as required.
- f) The contractor shall replace any lamps that are not operational or burn out within first 30 days after substantial completion.
- g) LED fixtures, modules, and drivers shall be listed by ANSI and tested per IESNA and ANSI for solid state lighting sources.
- h) Dimmers, where required, shall be provided such that they are compatible with the LED drivers and fixtures. Provide additional wiring required between the dimming drivers and the dimmer switch/dimming system as required for proper operation (verify wiring with manufacturer from what is shown on the drawings – provide additional wiring as required and include in the base bid). Coordinate compatibility requirements with the dimming system manufacturer and lighting fixture manufacturer prior to ordering any equipment or fixtures

- i) See fixture schedule.

26-48 CIRCUIT BREAKER PANELBOARDS:

- a) Provide dead-front panelboards with bolt-in or plug-on molded case circuit breakers. Panelboards shall comply with NEMA Publication PB1, UL 67 and UL50.
- b) Boxes shall be galvanized steel standard width and depth except where scheduled otherwise. Fronts shall be code gauge steel finish with rust inhibiting primer and based enamel finish. Fronts shall have flush doors with flush cylinder tumbler-type locks, spring loaded door pulls, and concealed door hinges. Provide doors higher than 48 inches with three (3) point catch. Panel door locks shall be keyed alike. Provide fronts designed for flush or surface mounting as indicated and attached to box by adjustable trim clamps. Verify cover type and installation with plans and install cabinet plumb and rigid.
- c) Provide tin-finished copper bars full length of panel with rating listed in schedule. Bus bar connections to branch circuit breakers shall be "Phase Sequence" type designed and assembled so circuit breakers can be replaced without disturbing adjacent breakers or without removing main bus or branch circuit connectors. Provide bus bars with wire lugs suitable or copper or aluminum conductors. Provide each panel with equipment grounding bus grounded to box and neutral bus insulated from box.
- d) Branch circuit breakers shall be quick-make, quick-break with trip indication. Circuit breakers shall operate both manually for normal switch functions and automatically under overload and short circuit conditions. They shall provide circuit and self protection when applied within their rating. Operating mechanisms shall be entirely trip free so that contacts cannot be held closed against a short circuit. Operating handle of circuit breaker shall simultaneously open and close all poles of a multiple breaker. Circuit breakers shall conform to UL489 and NFPA70. Circuit breaker shall have a thermal magnetic trip unit for each pole for inverse time delayed overload protection and an instantaneous magnetic element for short circuit protection. Trip elements shall operate a common internally connected trip bar to open all poles in case of overload or short circuit through any one (1) pole. Panel shall provide for branch circuit breakers up to 100 amperes, and unless indicated otherwise, shall have 10,000 RMS short circuit amperes symmetrical interrupting capacity. Breakers shall be one, two, or three pole types as indicated in panel schedule.
- e) Provide breaker as type and accessories per schedule. All heat trace or electric heating circuit breakers shall be 30mA GFEP class B type breakers. All kitchen and breakroom receptacles shall be GFI or wired to GFI circuit breaker. Provide filler plate in any unused spaces.
- f) Panels shall have branch circuit directory holders with clear plastic cover. Provide neatly typed circuit directory listing loads corresponding to branch circuit numbers. All panels shall have labels and arc fault indication as required in other sections of this specification.
- g) Provide one spare 0.75 inch conduit for every three (3) spaces and/or blank spaces with a minimum of three (3) spare conduits per panel. Terminate conduit above ceilings unless indicated otherwise.
- h) Panelboard shall be General Electric, ITE/Siemens, Square D, or Eaton/Cutler-Hammer.
- i) See schedule.

26-49 CIRCUIT BREAKER DISTRIBUTION PANELBOARDS:

- a) Panelboards shall be the I-Line distribution panelboards as manufactured by Square-D.
- b) Provide distribution and power panelboards as indicated in the panelboard schedule and where shown on the plans. Panelboards shall be equipped with thermal-magnetic, molded case circuit breakers of frame and trip ratings as shown on the schedule. Panelboard shall conform to NEMA PB1, UL 67 and UL 50.

- c) Panelboard bus structure and main breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests with maximum hot spot temperature on any connector or bus bar not to exceed 50 deg C rise above ambient. Heat rise tests shall be conducted in accordance with UL 67. The use of conductor dimensions will not be accepted in lieu of actual heat tests.
- d) Branch circuit breakers shall be Square D: HD, BD, JD, LA, MA, NH, PA and/or PC 1-, 2-, or 3-pole molded case circuit breakers rated 15 through 2500 amperes, (120 V ac) (240 V ac) (277 v ac) (480 C ac), as specified on the drawings. Breakers shall be standard construction. All circuit breakers shall be UL and CSA listed, IEC 157-1 rated, meet UL489, and Federal Specification W-C 375B/GEN, when applicable. Molded case circuit breakers shall have over center toggle-type mechanisms, providing quick-make, quick-break action. Breakers shall be calibrated for operation in an ambient temperature of 40 deg C. Each circuit breaker shall have trip indication by handle position and shall be trip-free. 2- and 3-pole breakers shall be common trip. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Circuit breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to assure uniform tripping characteristics in each pole). A push-to-trip button shall be provided on the cover from mechanically tripping the circuit breaker. The circuit breaker shall have reverse connection capability and be suitable for mounting and operating in any position. Unless otherwise indicated, branch circuit breakers up to 100 amperes shall have 10,000 RMS short circuit amperes symmetrical interrupting capacity. Circuit breakers above 100 ampere shall have 42,000 RMS capacities.
- e) Each panelboard, a complete unit, shall have a short circuit rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device with the panelboard connected to its rated voltage source. Method of testing shall be per UL 67. The source shall be capable of supplying the specified panelboard short circuit current or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.
- f) Panelboard assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL 50 for cabinets. The size of wiring gutters shall be in accordance with UL 67. Cabinets to be equipped with latch and tumbler-type lock on door of trim. Doors over 48 inches long shall be equipped with three-point latch and vault lock. All locks shall be keyed alike. Endwalls shall be removable. Fronts shall be of code gauge steel. Gray baked enamel finish electro-deposited over clean phosphatized steel.
- g) The panelboard interior assembly shall be dead front with panelboard front removed. Main lugs or main breakers shall have barriers on five sides. The barrier in front of the main lugs shall be hinged to a fixed part of the interior. The end of the bus structure opposite the mains shall have barriers.
- h) Equivalent manufacturers shall be General Electric, ITE/Siemens, Square D, or Eaton/Cutler-Hammer.

26-50 SURGE SUPPRESSION DEVICES:

- a) Surge Suppression devices shall also be referred to as SPD(s).
- b) Surge Protective Devices shall be provided at the following locations:
 1. Each main service entrance distribution panelboard, panelboard, switchboard or disconnect switch, whether specifically shown or noted on the electrical riser diagram or plans. Where the service main is a disconnect switch, locate SPD at the first distribution or branch panelboard downstream. Where there is not a distribution panelboard or branch panelboard, tap the incoming conductors as allowed by the National Electric Code, and provide SPD with integral fused disconnecting means.

2. Any other location as noted on the electrical riser diagram or plans.
- c) SPD(s) installed integral to the panelboard, distribution panelboard or switchboard shall not be allowed.
- d) SPD(s) shall be provided and installed as follows:
1. Work Included:
 - A. Surge Suppression/Filter System: Service Entrance – High Exposure.
 - B. Provide a complete SPD system, including (but not limited to), an externally mounted SPD unit, all interconnecting wiring between the main bus of the panelboard and the SPD unit, all conduit and all necessary hardware or accessories necessary for a complete installation in compliance with the equipment manufacturer's requirements.
 - C. The contractor shall be responsible for providing a 3-pole circuit breaker in the panelboard to feed the SPD unit, whether specifically scheduled or not. The size of the breaker shall be as recommended by the SPD manufacturer for the specific equipment provided.
 - D. The contractor shall be responsible for all wiring between the breaker and the external SPD and it shall be sized and installed as recommend by the SPD manufacturer for optimum operation. Where the lead length exceeds 5', the contractor shall use low impedance (HPI) cable to reduce the lead length's effect on the installed performance of the SPD. HPI cable shall be provided and installed as recommended by the equipment manufacturer.
 2. Quality Assurance:
 - A. Comply with the latest edition of the applicable provisions and recommendations of the following, except as otherwise stated in these specifications:
 - i. UL 1449 latest version.
 - ii. UL1283.
 - iii. ANSI/IEEE C62.41, Recommended Practice for Surge Voltages in Low Voltage AC Power Circuits.
 - iv. ANSI/IEEE C62.45, Guide for Surge Testing for equipment connected to Low Voltage AC Power Circuits.
 - v. UL96A.
 - vi. IEEE 1100 Emerald Book.
 - vii. National Fire Protection Association (NFPA 70, National Electric Code).
 3. Submittals:
 - A. Package must include shop drawings complete with all technical information, unit dimensions, detailed installation instructions, maintenance manual, recommended replacement parts list, warranty, and wiring configuration.
 4. Products:
 - A. Unless noted otherwise on the drawings (plans or riser), provide the model TG3-100-[voltage]-3GY-MN-[feed per field conditions]-M2-F-2 by Current Technology and model CGP-80-[voltage] for branch panels.

- B. Equivalentlets allowed by National Lightning Protection, Square D, ASCO and Innovative Technology/Eaton provided all requirements of the specifications below are met and submitted prior.
- C. SPD shall meet all the requirements and test procedures as outlined in NEMA LS-1 Standards "LOW VOLTAGE SURGE PROTECTIVE DEVICES". The unit shall be tested as a complete unit, with all fuses in place. A unit tested without fuses shall be considered as not compliant to NEMA LS-1. SPD shall meet the following minimum requirements:
 - i. Nominal voltage rating shall be three-phase, four-wire to match the main panel/switchboard voltage.
 - ii. Protection Method: MOV.
 - iii. Declared Maximum Continuous Operating Voltage (MCOV) shall be greater than 115 percent of the nominal operating voltage and in compliance with test and evaluation procedures outlined in the nominal discharge surge current test of UL 1449 latest edition. Each thermally protected MOV shall have end of life indicator and system shall be self monitoring. Unit with end of life short circuit is not acceptable.
 - iv. Each MOV shall be separately fused. Fuses shall be UL 248 listed. All shall be UL listed for type 1 and type 2 SPD applications. Surge current 150 (L-N) for 208V, 320 (L-N) for 480V.
 - (a) Service entrance location rated to 200-240kA.
 - (b) Distribution locations rated to 120-160kA.
 - (c) Branch locations rated to 80-100kA.
 - (i) EMI/RFI High Frequency Noise Filter Ratings: each unit shall include a high performance EMI/RFI noise rejection filter with a maximum attenuation of 50dB for 10-100MHz. The EMI/RFI noise rejection filter shall be included for all L-N modes shall include a removable filter in the N-G mode.
 - (ii) Enclosure shall be NEMA 3R rated where installed outdoors, NEMA 1 rated where installed indoors, unless noted otherwise. Refer to the plans for location.
 - (iii) Provide Standard monitoring system to include LED/phase indicators, audible alarm, dry relay contacts and a surge counter. (include advanced monitoring with Ethernet and Modbus communication)
- e) Installation, Start-up and Warranty:
 - 1. Follow all manufacturer's installation instructions and requirements.
 - 2. The SPD system shall be provided with a minimum 10-year warranty from the time of substantial completion.
 - 3. Surge Protectors shall be installed as close as practical to the electrical panel or dedicated electronic equipment to be protected. The SPD shall be close connected to the panel in a position near the panel board neutral bus bar or positioned so that the overall lead length will be minimal. Taps shall comply with NEC for compliance.
 - 4. The Surge Protector shall be installed in a manner consistent with proper and acceptable industry wiring practice. SPD connection leads shall be as short and straight as possible while avoiding sharp bends.

5. Surge Protectors provided with terminals shall be wired with stranded conductor size permitted within rating of lugs. Wire from circuit breaker to surge protector shall be installed in accordance with the National Electric Code and equipment manufacturer.
6. Local Factory representative shall perform start up and testing and shall supply written documentation of test. SPD's shall be energized after power system have been energized, stabilized and tested.

26-51 DRY TYPE TRANSFORMERS:

- a) Provide air cooled dry type two (2) winding transformer with ratings and capacities listed in schedule. Materials and performance shall comply with applicable ANSI, NEMA, IEEE and UL 506 and UL1561 standards.
- b) Provide 3-phase transformers rated 15 KVA and below with 2 to 5 percent full capacity taps below normal and 3-phase transformers 30 KVA and above with 2 to 2.5 percent taps above and 4 to 4.5 full capacity taps below normal primary voltage. No taps are required for single phase transformers rated 15 KVA and below. Provide single phase transformers 25 KVA and above with 2 to 2.5 percent above 4 to 4.5 percent below normal primary voltage.
- c) Coil windings shall be continuous from start to finish without splicing. Materials incorporated must have a minimum of one year of proven field usage. Accelerated laboratory test in lieu of field usage will not be acceptable. Transformers coils shall have final wrap of electrical insulating materials to prevent injury to magnetic wire.
- d) Transformer cores shall be manufactured from high grade, nonaging silicone steel with high magnetic permeabilities, low hysteresis and eddy current losses.
- e) Core and coil units shall be completely isolated from enclosure by means of vibration absorbing mounts with no metal contact between core and coil and enclosure. On units 500 KVA and smaller, vibration isolating system shall provide for continual securement of core and coil unit to enclosure. Sound isolating systems requiring removal of tie down facilities will not be acceptable.
- f) Transformers 10 KVA and smaller shall be provided in non-ventilated enclosure. Ventilated openings must prevent accidental access to electrically live parts. Use of expanded metal sides will not be acceptable. Provide lifting eyes on all transformers designed so that spreader bars are not required for lifting.
- g) Transformers 10 KVA and smaller shall be suitable for all mounting. Provide transformers 15 KVA through 75 KVA with interchangeable mounting for floor, wall, or ceiling. Secure all transformer per manufacturer recommendations.
- h) Entire transformer enclosure shall be primed with zinc chromate and finished with a coat of baked enamel. Enclosure shall allow for 2" clearance on sides and behind transformer.
- i) Core and coils shall be visible grounded to frame of transformer cubicle by means of a flexible grounding strap of adequate size. Provide all required bonding and ground bar per NEC 450 and per DOE 2016.
- j) All transformers shall comply with efficiency requirements of DOE-2016 and sound levels of NEMA ST-20.
- k) Provide transformers meeting above specification by Square D, General Electric, Heavy-Duty, Cutler Hammer, or ITE/Siemens.
- l) Weatherproof, NEMA 3R enclosures with weather-shields shall be provided for all transformers installed in outdoor locations.

- m) Fan-assisted cooling transformers are not allowed. Transformers shall have 220 degree C insulation system and rated for 150 degree C rise unless otherwise scheduled.
- n) See transformer schedule.

26-52 GROUNDING:

- a) Supplement grounded neutral of secondary distribution system with equipment grounding system, installed so that metallic structures, enclosures, raceways, junction boxes, cabinets, machine frames, portable equipment, and other conductive items operate continuously at ground potential and provide low impedance path for ground fault currents. System shall comply with NEC section 250, modified as indicated on drawings as specified.
- b) Provide equipment ground bus in base of low voltage switchgear or switchboard. Braze or otherwise adequately connect ground system to at least three (3) 0.75-inch diameter by 10-foot ground rods. Where extra rods are necessary to meet requirements of specified tests, E/C shall be reimbursed for additional cost. Rods shall be located a minimum of 6 feet from each other of any other electrode and shall be interconnected by a minimum 3/0 bare copper conductor brazed to each ground rod below grade. Ground rods shall be driven 2" below finish floor or grade unless otherwise indicated.
- c) Ground all metallic water piping systems (domestic water, chilled/hot water, condenser water, etc.) in the building to electrical service ground with a minimum 3/0 or as required green insulated copper ground conductor, in conduit. Where a dielectric fitting is installed anywhere in the system, or where a non-conductive fitting is installed, the piping system on each side of the fitting shall be separately bonded. On the main water service, connect ground conductor to building side of dielectric water fittings. Do not install jumpers around dielectric water fittings. Bond piping to ground conductor at each end. Provide 3/0 jumper with ground clamps around water meter. Coordinate with mechanical contractor and include all associated costs in the base bid.
- d) Connect system neutral ground and equipment ground system to common ground bus.
- e) Ground secondary services at supply side of each individual secondary disconnecting means and at related transformers in accordance with NEC. Provide each service disconnect enclosure with neutral disconnecting means which interconnect with insulated neutral and uninsulated equipment ground sub to establish system common ground point. Neutral disconnecting links shall be located so that low voltage neutral bar with interior secondary neutrals can be isolated from common ground bus and service entrance conductors.
- f) Required equipment grounding conductors and straps shall be sized in compliance with NEC Table 250-66. Equipment grounding conductors shall be provided with green Type TW 600 volt insulation. Related feeder and branch circuit grounding conductors shall be connected to ground bus with approved pressure connectors. Provide feeder servicing several panelboards with a continuous grounding conductor connected to each related panelboard ground bus.
- g) Provide low voltage distribution system with a separate green insulated equipment grounding conductor for each single or 3-phase feeder and each branch circuit except as specified herein. Where more than one branch circuit is installed in a common raceway only one grounding conductor is required. Grounding conductor shall be sized for largest branch circuit overcurrent device serving common raceway.
- h) Single phase 120 and 277 volt branch circuits for lighting shall consist of phase and neutral conductors installed in common metallic conduit which shall serve as grounding conductor. Provide flexible metallic conduit utilized in conjunction with above single phase branch circuits with suitable green insulated grounding conductors. Single phase branch circuits required for special equipment, such as X-ray, etc., feeders and branch circuits in non-metallic conduits shall be provided with separate grounding conductor. Install grounding conductor in common conduit with related phase and/or neutral conductors. Where parallel feeders are installed in more than one raceway, each raceway shall have a green insulated equipment grounding conductor.

- i) E/C shall provide equipment grounding bars for termination of equipment grounding conductors in panelboards and other electrical equipment. In addition to active circuits, provide pressure connectors for panel spares and blank spaces. E/C/ responsible for grounding of all CATV, phone, and telecommunication systems per NEC. Coordinate with system provider.
- j) Provide electrical expansion fitting with an external flexible copper ground securely bonded by approved grounding straps on each end of fitting except where UL approved built-in copper grounding device is provided.
- k) Connect each cable rack system to equipment grounding system with insulated conductor with size determined by largest power conductor in rack. Minimum size shall be No. 6 and maximum size shall not exceed equivalent capacity of number 4/0 copper conductor. Ground conductor shall be bonded to rack system, enclosed in conduit, and connected to common ground bus.
- l) Provide electric devices such as air cleaners or heater control switches, etc., installed in air ducts with insulated equipment ground conductor sized on rating of overcurrent device supplying unit. Bond conductor to each unit, air duct, and to ground in panelboard.
- m) Provide electric immersion type water heater or surface heating cables with insulated equipment ground conductor sized on rating of overall device supplying unit. Bond conductor to water piping at unit and to ground bar in panelboard.
- n) Provide steel and aluminum conduits which terminate without mechanical connection to metallic housing of electrical equipment with ground bushing and connect each bushing with bare copper conductor to ground bus in electrical equipment. Electrically non-continuous metallic conduits containing ground wiring only shall be bonded to ground wire at both conduit entrance and exit.
- o) Ground and bond exterior mounted light poles, radio and television masts and flag poles with No. 6 or larger bare copper wire connected to 96-inch long, 0.75-inch copper clad ground rod driven in ground.
- p) Test complete equipment grounding system to each service disconnect enclosure ground bar in accordance with IEEE81. Submit certified test reports of compliance with 5 ohm measured ground resistance value.
- q) Provide a No. 6 ground conductor to all telephone/computer/television/audio/visual racks in all telephone equipment rooms (and where indicated in the contract documents) whether specifically shown or noted on the drawings. Provide a minimum of 60 inches of free wire at the termination for connection to owner-provided racks. Coordinate exact location and requirements with the owner prior to any rough-in. Provide 0.25"x4" grounding bus bar with holes 0.28 holes spaced 1.125" apart for all main IT rooms. Include mechanical type, cast silicon bronze, solderless terminals and UL891 listed stand-off insulators rated for 600V.
- r) All equipment and panel grounds shall be bonded to a common building ground system per the National Electric Code, whether specifically shown on the electrical riser diagram or not. This includes all of the separately derived systems in the building (transformers) that are required to bond to the nearest grounding electrode. This shall be provided per section 250.30 of the NEC, by the electrical contractor and included in the base bid. Comply with all requirements be local authority having jurisdiction.

26-53 LIGHTING CONTROL DEVICES:

a) Work Included:

- 1. Contractor's work to include all labor, materials, tools, appliances, control hardware, sensor, low voltage cable and wiring, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational local lighting control system, as described herein.

b) System:

1. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area or otherwise controlled from daylighting or other room sensors.
 - A. Submit a lighting plan clearly marked by manufacturer showing proper product, location and orientation of each sensor. Submit any interconnection diagrams per major subsystem showing proper wiring.
 - B. Components shall communicate via low voltage wiring and wired per manufacturer's instructions. Cabling shall be plenum rated where installed above accessible ceilings. Cabling in walls, above non-accessible ceilings, and in exposed areas shall be in conduit.
 - C. Provide emergency shunt replays as noted for operation as normally closed, electrically held relay for manual or automatic switch complying with UL924 for voltage matching lighting circuit.
- c) Where required, provide a local DLM network to provide physical connection and communication protocol designed to control a small area of a building. Features of the DLM local network include:
 1. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 2. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
 3. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 4. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
- d) Products:
 1. Load Controllers (Room, Plug Load, and Fixture Controllers):
 - A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/ potentiometers, or require special configuration for standard Plug n' Go applications. Each load controller shall be programmed to meet the sequence of controls shown on the drawings.
 - B. Plug Load Controllers:
 - i. Controllers shall be 120VAC, 60Hz rated for 20A total load and shall carry application specific UL 20 rating for receptacle control.
 - ii. One relay configuration with additional connection for unswitched load
 - iii. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10 minute additive delay in a space with a 20 minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
 - iv. Program to meet the sequence of controls shown on the drawings.

- C. Fixture Controllers:
 - i. A form factor and product ratings to allow various OEM fixture manufacturers to mount the device inside the ballast/driver cavity of standard-sized fluorescent or LED general lighting fixtures.
 - ii. One 3A 120/277V rated mechanically held relay.
 - iii. Programmable behavior on power up following the loss of normal power.
 - iv. Provide power from nearest room controller to operate fixture controller if not shown on drawings.
 - v. 0-10V dimming capability via a single 0-10 volt analog output from the device for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Fixture Controller.
 - vi. Refer to lighting device schedule.
- 2. Occupancy or Vacancy Sensors (Ceiling, Wall, or Wall Switch type):
 - A. Program sensors to meet the sequence of controls shown on the drawings. In general, occupancy mode shall mean automatic-on/automatic-off operation and vacancy mode shall mean manual-on/automatic-off operation with field capability to switch operation. Sensors shall have bypass switch to override "on" function in event of sensor failure. Sensors shall have the following functionality:
 - i. Time delay adjustment from 1-15 minutes in 1 minute increments, test mode, and walk-through mode.
 - ii. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - iii. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. Retrigger mode can be programmed to use ultrasonic (US) and/or passive infrared (PIR).
 - iv. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
 - B. Provide and wire through power pack as required. Provide dual technology type unless PIR or Ultrasonic is otherwise indicated.
 - C. Device shall be suitable for mounting on standard outlet box. Relays shall be externally mounted in standard electrical enclosure. Time delay and sensitivity adjustments shall be recessed and concealed behind hinged door.
 - D. Provide switch sensor type as indicated. Switch sensors shall have 180 degree field of view, field adjustable from 180 to 40 degree, capable of 3-way operation, have override button, and have field adjustable time delay selector.
 - E. Digital occupancy/vacancy sensors shall provide graphic LCD display for digital calibration and electronic documentation where noted.
 - i. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls as required.

- ii. Device Status LEDs, which may be disabled for selected applications.
 - iii. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 - iv. Manual override of controlled loads.
 - v. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
 - vi. BACnet object information.
 - vii. Refer to lighting device schedule.
3. Digital Wall Switches:
- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration with programmable control functionality. Device color and plate shall match as required in other sections of the specification.
 - B. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
 - C. BACnet object information.
 - D. Switches shall be capable of manually overriding photosensors, occupancy sensors, or time controls. See plans for the sequence of controls. Provide quantity of switches as required to meet design intent.
 - E. Refer to lighting device schedule.

e) Installation:

1. It shall be the contractor's responsibility to locate and aim sensors in the correct location required for complete and proper volumetric coverage within the range of coverage(s) of controlled areas per the manufacturer's recommendations. Rooms shall completely cover the controlled area to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only the rooms which are to be provided with sensors. The contractor shall provide additional sensors if required to cover the respective room properly and completely.
2. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
3. Provide wiring per manufacturer recommendations and install as required in other specification sections.
4. Proper judgment must be exercised in executing the installation so as to ensure the best possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural components. The contractor shall also provide, at the owner's facility, the training necessary to familiarize the owner's personnel with the operation, use, adjustment, and problem-solving diagnosis of the occupancy sensing devices and systems. Locations shown on plans are schematic and shall be modified as required in field to accommodate obstructions and undesired exposures.

5. The contractor shall test, program, and adjust equipment as required and shall include complete installation and startup checks according to the manufacturer's written instructions. When requested, the contractor shall provide one additional follow up trip for programming adjustments after substantial completion and initial system adjustments as noted during owner walk-thru.
6. Equivalent manufacturer by Wattstopper, Leviton, Greengate, and Hubbell or by prior approval only.

26-54 TIME SWITCHES:

- a) Provide astronomical electrical 7-day programmable time switches as indicated on drawings and in schedule.
- b) Equivalent by Intermatic, Tork, or Rainbird.
- c) See the time switch schedule.

26-55 FIRE ALARM SYSTEM:

- a) Related Documents:
 1. Drawings and general provisions of the contract including general and supplementary conditions and Division 1 specification sections, apply to this section.
 2. Requirements of the following Division 26 sections apply to this section.
 - A. "26 – Electrical Requirements."
 - B. The complete installation is to conform to the applicable sections of NFPA 72 and the NEC with particular attention to Article 760.
 - C. NFPA 101 – Life Safety Code.
- b) Summary:
 1. This section includes fire alarm systems, including manual stations, detectors, notification appliances, signal equipment, controls, smoke control and devices.
 2. Work covered by this specification section includes the furnishing of labor, equipment, materials, and complete operational performance required for installation of the fire alarm system as shown on the drawings, as specified, and as directed by the A/E.
 3. The work covered by this section of the specification is to be coordinated with the related work as specified elsewhere under the project specifications.
 4. The fire alarm system shall consist of all necessary hardware equipment and software programming to perform the following functions:
 - A. Fire alarm and detection operations.
 - B. Remote manual and automatic control of elevators, door hold-open devices, fire suppression appliances, and/or off-premises notification.
 - C. Dual line DACT communicator with modem for external, remote supervision monitoring coordinated with owner's current supervision system if applicable. Communication protocol shall be compliant with NFPA.

c) System Descriptions:

1. General: Complete, non-coded, addressable, microprocessor-based fire detection and alarm system with manual and automatic alarm initiation. Fire signal initiation shall be from pull stations, heat detectors, smoke detectors, duct smoke detectors, gas detectors, flow switch, tamper switches, etc. as required by code and indicated on plans. Notification shall operate notification appliances, identify initiating devices, transit signals to remote receiving location, release fire/smoke doors held by magnetic holders, activate alarm/voice system as applicable, and control any hvac equipment controls or dampers, smoke control systems or any other applicable systems in the building. Include all work and notification for supervisory and trouble signals per NFPA.
2. The facility shall have an emergency voice alarm communication system. Digitally stored message sequences shall notify the building occupants that a fire or life safety condition has been reported. Message generator(s) shall be capable of automatically distributing up to eight (8) simultaneous, unique messages to appropriate audio zones within the facility based on the type and location of the initiating event. The Fire Command Center (FCC) shall also support Emergency manual voice announcement capability for both system wide or selected audio zones and shall include provisions for the system operator to override automatic messages system wide or in selected zones.

A. Automatic Voice Evacuation Sequence:

- i. The audio alarm signal shall consist of an alarm tone for a maximum of five seconds followed by an automatic digital voice message. At the end of the voice message, the alarm tone shall resume. This sequence shall sound continuously until the "Alarm Silence" switch is activated.
- ii. All audio operations shall be activated by the system software so that any required future changes can be facilitated by authorized personnel without any component rewiring or hardware additions.
- iii. Speaker: Speaker notification appliances shall be listed to UL 1480.
- iv. The speaker shall operate on a standard 25VRMS or 70.7VRMS NAC using twisted/shielded wire.
- v. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 84dBA at 10 feet.
- vi. The speaker shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for General Signaling.
- vii. Audible alarm notifications by voice evacuation and tone signals on loudspeakers throughout. The audio signal shall include a 520hz tone for all sleeping areas.
- viii. The system shall be configured to allow voice paging. Upon activation of any speaker manual control switch, the alarm tone shall be sounded over all speakers in that group. The control panel operator shall be able to make announcements via the push-to-talk paging microphone over the pre-selected speakers. Facility for total building paging shall be accomplished by the means of an "All Call" switch. Coordinate all paging and zones with owner for programming of building.
- ix. Mass Notification Override: The system shall be UL 2572 listed for Mass Notification and shall be capable, based on the Risk Analysis, of being programmed so that Mass Notification/Emergency Communications events take precedence over fire alarm events.

3. The fire alarm system shall allow for loading and editing special instructions and operating sequences as required. The system shall be capable of on-site programming to accommodate system expansion and facilitate changes in operation. All software operations shall be stored in a non-volatile programmable memory within the fire alarm control unit. Loss of primary and secondary power shall not erase the instructions stored in memory.
4. The system shall have the capability of loading software operations from a single node to all other nodes on the network.
5. The system shall have the capability of recalling alarms and trouble conditions in chronological order for the purpose of recreating an event history. A separate alarm and trouble log shall be provided.
6. The new panel shall integrate ALL existing fire alarm panels for the high school building. All panels shall annunciate and remote call via new system dialer. Contractor shall be responsible for all work to incorporate existing components into new single system.

d) Submittals:

1. General: Submit the following according to conditions of contract and Division 26 specification sections.
2. Product Data for System Components: Include dimensioned plans and elevations showing minimum clearances and installed features and devices. Include list of materials and NRTL-listing data.
3. Submissions to Authority Having Jurisdiction: In addition to routine submissions of the above material, make an identical submission to the authority having jurisdiction. Include copies of annotated contract drawings as required to depict component locations to facilitate review. Upon receipt of comments from the authority, submit them for review. Make resubmissions if required to make clarifications or revisions to obtain approval. Submit all required battery calculations, performance parameters, equipment layout and wiring per recommendations per NFPA 72.
4. The submittal shall also include one set of plans with all devices located on the plans and numbered individually. It shall also include a detailed riser diagram with all devices and wiring requirements indicated on the plans. The fire alarm shop drawings shall not be approved without this submittal.
5. Provide as-built documentation and device address list to owner.

e) Quality Assurance:

1. Installer Qualifications: A factory-authorized installer is to perform the work of this section and shall have NICET certified personnel.
2. Compliance with Local Requirements: Comply with the applicable building code, local ordinances and regulations, and the requirements of the authority having jurisdiction.
3. All work shall be in compliance with applicable sections of NFPA.
4. All items of the fire alarm system shall be listed as a product of a single US manufacturer or division under the appropriate category of UL shall be the UL label.

f) Manufacturers:

1. The allowed bidders shall be Simplex, Firelite, Notifier, Honeywell, Siemens. Request for substitutions shall be in accordance with Section 26.

g) Extra Materials:

1. General: Furnish extra materials, packaged with protective covering for storage, and identified with labels clearly describing contents as follows:
 - A. Break Rods for Manual Stations: Furnish quantity equal to 15 percent of the number of manual stations installed; minimum of 6 rods.
 - B. Strobe Units: Furnish quantity equal to 10 percent of the number of units installed, but not less than one.
 - C. Smoke Detectors or Sensors, Fire Detectors, and Flame Detectors: Furnish quantity equal to 10 percent of the number of units of each type installed but not less than one of each type.
 - D. Detector or Sensor Bases: Furnish quantity equal to 2 percent of the number of units of each type installed but not less than one of each type.

h) Products:

1. Fire Alarm Control Panel (FACP):
 - A. General: Comply with UL 864, "Control Units for Fire-Protective Signaling Systems."
 - B. Cabinet: Lockable steel enclosure. Arrange unit so all operations required for testing or for normal care and maintenance of the systems are performed from the front of the enclosure. If more than a single unit is required to form a complete control unit, provide exactly matching modular unit enclosures. Accommodates all components and allow ample gutter space for interconnection of units as well as field wiring. Identify each enclosure by an engraved, red-laminated, phenolic resin nameplate. Lettering on the enclosure nameplate shall not be less than 1-inch high.
 - C. Systems: Alarm and supervisory systems are separate and independent in the FACP. The alarm-initiating zone boards in the FACP consist of plug-in modules. Construction requiring removal of field wiring for module replacement is not acceptable.
 - D. Control Modules: Types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals notify of alarm, supervisory, and trouble conditions.
 - E. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at FACP and addressable system components, including annunciation, supervision, and control. A display with a minimum of 80 characters displays alarm, supervisory, and component status messages and indicates control commands to be entered into the system for control of smoke detector sensitivity and other parameters. Arrange keypad for use in entering and executing control commands.
 - F. Instructions: Printed or typewritten instruction card mounted behind a LEXAN plastic or glass cover in a painted steel or aluminum frame. Install the frame in a location observable from the FACP. Include interpretation and appropriate response for displays and signals; and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
 - G. Power panel with 120V input power, sealed, lead acid battery and charging circuits, fused disconnect, auxiliary relay, and all required power supplied for devices and 25% future capacity. Provide sufficient capacity to operate the complete alarm system in normal or supervisory (non-alarm) mode for a period of 24 hours. Following this period of operation on battery power, the battery shall have sufficient capacity to operate all components of

the system, including all alarm indicating devices in alarm or supervisory mode for a period of 15 minutes.

- H. Addressable Network:
 - i. Communication with Addressable Devices: The system must provide communication with initiating and control devices individually. All of these devices will be individually annunciated at the control panel.
 - ii. All addressable devices shall have the capability of being disabled or enabled individually.
 - iii. A minimum of 10,000 total feet of twisted, shielded 18 AWG wire may be connected to channel. The maximum distance from the panel to the farthest device shall be 2,500 feet.
 - I. Historical event logs shall be available from the LCD display or shall be capable of being printed.
 - J. The minimum panel capacity shall be 198 addressable devices, with provisions for expansion modules to support existing buildings and future additions.
 - K. Remote Annunciator(s) with two-line LCD display of alarm, supervisory, and status messages with keypad operation.
 - i. Provide LCD remote annunciator(s) at entrance or in location as indicated on the plans.
 - L. Voice Alarm: Provide an emergency communication system, integral with the FACP, including voice alarm system components, microphones, amplifiers, and tone generators. Features including amplifiers, dedicated supervised communication lines and emergency voice communication controller with status indicator.
2. Manual Pull Stations:
- A. Description: Addressable single- or double-action type, red LEXAN, with flush mounting plate and molded, raised-letter operating instructions of contrasting color. Station will mechanically latch upon operation and remain so until manually reset by opening with a key common with the control units.
 - B. Protective Shield: Where required provide a tamperproof, clear LEXAN shield and red frame that easily fits over manual pull stations. When shield is lifted to gain access to the station, a battery powered piercing warning horn shall be activated. The horn shall be silenced by lowering and realigning the shield. The horn shall provide 85dB at 10 feet and shall be powered by a 9 VDC battery.
3. Smoke Sensors:
- A. General: Comply with UL 268, "Smoke Detectors for Fire Protective Signaling Systems." Include the following features:
 - i. Factory Nameplate: Serial number and type identification.
 - ii. Operating Voltage: 24 VDC, nominal.
 - iii. Addressability: Sensors include a communication transmitter and receiver in the mounting base having a unique identification and capability for status reporting to the FACP. Detectors that store the device address in the head shall be acceptable.

Sensors do not require resetting or readjustment after actuation to restore normal operation.

- iv. Each sensor twist lock base shall contain an LED that will flash each time it is scanned by the control unit (once every 4 seconds). In alarm condition, the sensor base LED shall be on steady.
 - v. Each sensor base shall contain a magnetically actuated test switch to provide for an easy alarm testing at the sensor location.
 - vi. Each sensor shall be scanned by the control unit for its type identification to prevent inadvertent substitution of another sensor type. Upon detection of a "wrong device," the control unit shall operate with the installed device at the default alarm settings for that sensor; 2.5 percent obscuration for photoelectric sensor, 135 deg F and 15 deg F rate-of-rise for heat sensor but shall indicate a "wrong device" trouble condition.
 - vii. The sensor's electronics shall be immune from false alarms caused by EMI and RFI.
 - viii. Removal of the sensor head for cleaning shall not require the setting of addresses.
- B. Photoelectric Smoke Detectors: Include the following features and characteristics:
- i. An infrared detector light with matching silicon cell receiver and actuated by the presence of visible products of combustion. Must have seven sensitivity settings and transmit actual values to the FACP.
- C. Ionization-Type Smoke Detector: Include the following features and characteristics:
- i. Multiple-chamber-type operating on the ionization principle and actuated by the presence of invisible products of combustion.
- D. Duct Smoke Detector: Photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applicable. Required on the return for all units over 2000cfm and supply and return side of all AHU over 15,000 CFM.
- i. The addressable duct smoke sensors shall be photoelectric type, with sampling tube of design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied. The sensor includes relay as required for fan shutdown. Environmental compensation, programmable sensitivity settings, status testing, and monitoring of sensor dirt accumulation for the duct sensor shall be provided by the FACP.
 - ii. The duct housing shall provide a supervised relay driver circuit for driving up to 15 relays with a single "Form C" contact rated at 7A at 28 VDC or 120 VAC resistive. This auxiliary relay output shall be fully programmable.
 - iii. Duct housing shall have a relay control trouble indicator yellow LED, and a magnetic test area and red sensor status LED.
 - iv. For maintenance purposes, it shall be possible to clean the duct housing sampling tubes by accessing them through the duct housing front cover.
 - v. Each duct detector shall have a remote test station with an alarm LED and test switch located in an accessible location. Coordinate with electrical contractor.

4. Other Detectors:

- A. Thermal Sensor: Combination fixed-temperature and rate-of-rise unit with plug-in base and alarm indication lamp; 135-deg F fixed-temperature setting except as indicated.
 - i. Thermal sensor shall be of the epoxy encapsulated electronic design. It shall be thermistor-based, rate-compensated, self-restoring and shall not be affected by thermal lag.
 - ii. Sensor fixed temperature sensing shall be independent of rate-of-rise sensing and programmable to operate at 135-deg F or 155-deg F. Sensor rate-of-rise temperature detection shall be selectable at the FACP for either 15-deg F or 20-deg F per minute.
 - iii. Sensors shall have the capability to be programmed as a utility monitoring device to monitor for temperature extremes in the range from 32-deg F to 155-deg F.
 - B. Multi-Sensors shall combine photoelectric smoke sensing and heat sensing technologies and carbon monoxide as indicated. An alarm shall be determined by either smoke detection, with selectable sensitivity from 0.2 to 3.7 %/ft obscuration; or heat detection, selectable as fixed temperature or fixed with selectable rate-of-rise; or based on an analysis of the combination of smoke and heat activity.
5. Addressable Circuit Interface Modules:
- A. Addressable Circuit Interface Modules: Arrange to monitor one (1) or more system components that are not otherwise equipped for addressable communication. Modules shall be used for monitoring of waterflow, valve tamper, non-addressable devices, and for control of evacuation indicating appliances and AHU systems. Provide connection for all devices provided by sprinkler contractor whether indicated on drawings or not.
 - B. Addressable circuit interface modules will be capable of mounting in a standard electric outlet box. Modules will include cover plates to allow surface or flush mounting. Modules will receive their operating power from the signaling line or separate 2-wire pair running from an appropriate power supply as required.
 - C. The circuit interface module shall be supervised and uniquely identified by the control unit. Module identification shall be transmitted to the control unit for processing according to the program instructions. Modules shall have an on-board LED to provide an indication that the module is powered and communicating with the FACP. The LEDs shall provide a troubleshooting aid since the LED blinks on poll whenever the peripheral is powered and communicating.
6. Magnetic Door Holders:
- A. Description units shall be listed to UL 228. Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Units shall operate from a 24 VDC source and develop a minimum of 25 pounds holding force. Finish shall match door hardware.
7. NAC Power Extender:
- A. The Power Extender panel shall be a stand-alone panel capable of powering a minimum of 4 notification appliance circuits. Notification appliance circuits shall be rated at 2 amps each. Panel shall provide capability to be expanded to 8 notification appliance circuits.
 - B. The internal power supply & battery charger shall be capable of charging up 12.7 Ah batteries internally mounted or 18Ah batteries mounted in an external cabinet.

- C. The NAC extender panel may be mounted close to the host control panel or can be remotely located. The Extender Panel, when connected to an addressable panel shall connect to the host panel.
 - D. When connected to a conventional (non-addressable panel) one or two standard notification appliance circuits from the main control panel may be used to activate all the circuits on the NAC power extender panel.
 - E. Alarms from the host fire panel shall signal the NAC power extender panel to activate. The panel shall monitor itself and each of its NACs for trouble conditions and shall report trouble conditions to the host panel.
8. Alarm Notification Appliances:
- A. Notification Appliances: The Contractor shall furnish and install non-addressable notification appliances and accessories to operate on compatible signaling line circuits (SLC).
 - B. Addressable notification appliance operation shall provide power, separate control, and supervision of horns, speakers, and strobes over a single pair of wires. The controlling channel (SLC) digitally communicates with each appliance and receives a response to verify the appliance's presence on the channel. The channel provides a digital command to control appliance operation. SLC channel wiring shall be unshielded twisted pair (UTP), with capacitance rate of less than 60 pf/ft and a minimum of three (3) twists per foot.
 - C. All Notification Appliances shall operate as a completely independent device allowing for specific location alerting of both fire alarm and Mass Notification functions. Each visible device (both clear fire alarm and amber mass notification) shall be capable of operating on multiple notification zones or completely separate from all other notification devices, this allows "On the fly" program operation changes for Mass Notification alerting and fire alarm notification.
 - D. Class B (Style 4) notification appliances shall be wired without requiring in/out wiring methods.
 - E. Visible/Only (V/O): Strobe shall be listed to UL 1971. The V/O shall consist of a xenon flash tube and associated lens/reflector system. The V/O enclosure shall mount directly to standard single gang, double gang, or 4-inch square electrical box without the use of special adapters or trim rings. Appliances shall be wired with UTP conductors, having a minimum of three (3) twists per foot. V/O appliances shall be provided with different minimum flash intensities of 15, 30, 75 and 110cd. Provide a label inside the strobe lens to indicate the listed candela rating of the specific V/O appliance.
 - F. Audible/Visible (A/V): Combination A/V notification appliances shall be listed to UL 1971 and UL 464. The strobe light shall consist of a xenon flash tube and associated lens/reflector system meeting requirements listed above. The horn shall have a minimum sound pressure level of 80 dBA at 24 VDC. The A/V enclosure shall mount directly to standard single gang, double gang, or 4-inch square electrical box without the use of special adapters or trim rings.
 - G. Appliances shall be wired with UTP conductors, having a minimum of three (3) twists per foot. The appliance shall be capable of 2-wire synchronization to provide synchronized strobe with steady or coded pattern on horn.
 - H. Speaker/Visible: Combination Speaker/Visible (S/V) units combine the speaker and visible functions into a common housing. The S/V shall be listed to UL 1971 and UL 1480. Addressable functionality controls visible operation, while the speaker operates on a 25VRMS or 70.7VRMS NAC. All devices mounted on ceiling shall be white. Any speakers in sleeping rooms shall include a 520hz tone.

- i. Twisted/shielded wire is required for speaker connections on a standard 25VRMS or 70.7VRMS NAC and UTP conductors, having a minimum of 3 twists per foot is required for addressable strobe connections.
 - ii. The following taps are available: 0.25W, 0.50W, 1.0W and 2.0W. At the 1.0W tap, the speaker has minimum UL rated sound pressure level of 82 dBA at 10 feet.
 - iii. The S/V shall have a frequency response of 400 to 4000 Hz for Fire Alarm and 125 to 12kHz for general signaling.
 - iv. The S/V installs directly to a 4" square, 1 ½" deep electrical box with 1 ½" extension.
- I. All the fire sprinkler tamper and flow switches shall be connected to the main fire alarm system. Coordinate exact location and requirements with fire sprinkler contractor. Tamper and flow switches are provided by the fire sprinkler contractor per section 21 of the specifications. The fire alarm contractor shall provide all hardware, software and wiring necessary for connection of all these switches to the fire alarm system. Coordinate with the fire sprinkler contractor and include all of them in the base bid.
 - J. Tamper switches, and modules for monitoring high pressure, low pressure and flow are required at all the dry pipe sprinkler compressors in the building. Coordinate all requirements with the fire sprinkler contractor and include in the base bid.
 - K. The tamper switch for each of the fire sprinkler post indicator valves shall be provided by the fire alarm contractor and connected to the building fire alarm system. Coordinate exact location and requirements with fire sprinkler contractor. This and the wiring/conduit required shall be included in the base bid whether specifically indicated on the drawings or not.
 - L. Provide fire alarm fan shut down relays for rooftop units over 2000cfm in the building whether specifically shown on the drawings or not. The activation of any building smoke detector or duct detector shall cause all units to shut down.
 - M. Provide weatherproof housing for all devices installed at the exterior of the building.
- i) Installation – General:
- 1. Install system according to NFPA standards referenced in Parts 1 and 2 of this section.
 - 2. Fire Alarm Power Supply Disconnect: Shall be painted red and labeled "FIRE ALARM." Provide with a lockable handle or cover.
 - 3. All wiring shall be in conduit where exposed and in accordance with NFPA.
- j) Equipment Installation:
- 1. Furnish and install a complete Fire Alarm System as described herein and as shown on the plans. Include sufficient control unit(s), annunciator(s), manual stations, automatic fire detectors, smoke detectors, audible and visible notification appliances, wiring, terminations, electrical boxes, and all other necessary material for a complete operating system.
 - 2. Water-Flow and Valve Supervisory Switches: Connect for each sprinkler valve required to be supervised.
 - 3. Device Location-Indicating Lights: Locate in the public space immediately adjacent to the device they monitor.
- k) Wiring Installation:

1. Wiring Method: Install wiring in metal raceway according to this specification and per NEC and NFPA. Conceal raceway except in unfinished spaces as indicated.
2. The contractor shall obtain from the Fire Alarm System Manufacturer written instructions regarding the appropriate wire/cable to be used for this installation. No deviation from the written instruction shall be made by the Contractor without the prior written approval of the Fire Alarm System Manufacturer.
3. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm initiating device circuits wiring and a different color code for supervisory circuits. Color-code notification appliance circuits differently from alarm-initiating circuits. Paint fire alarm system junction boxes and covers red.
4. Provide all ethernet connections to panel. The electrical contractor shall coordinate and ensure proper Ethernet connections occur at the fire alarm control panel and other designated equipment locations prior to system turnover.

l) Grounding:

1. Ground equipment and conductor and cable shields as specified by the equipment manufacturer. For audio circuits minimize to the greatest extent possible ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

m) Field Quality Control:

1. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
2. Pretesting: Upon completing installation of the system, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the drawings and specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
3. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.
4. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
5. Minimum Systems Tests: Test the systems according to the procedures outlined in NFPA 72.
6. Retesting: Correct deficiencies indicated by tests and complete retest work affected by such deficiencies. Verify by the system test that the total system meets the specifications and complies with applicable standards.
7. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.
8. Tag all equipment, stations, and other components at which tests have been satisfactorily completed. Final test, certificate of completion, and certificate of occupancy.
9. Test the system as required by the Authority Having Jurisdiction to obtain a certificate of occupancy. Demonstrate that the system meets the specifications and complies with applicable

standards. This final test shall be witnessed by a representative of the Authority Having Jurisdiction and a factory authorized service representative.

n) Cleaning and Adjusting:

1. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
2. Occupancy Adjustments: When requested within one year of date of substantial completion, provide on-site assistance in adjusting sound levels and adjusting controls and sensitivities to suit actual occupied conditions. Provide up to three (3) visits to the site for this purpose.

o) Training:

1. Provide the services of a factory-authorized service representative to demonstrate the system and train Owner's maintenance personnel as specified below.
2. Train Owner's maintenance personnel in the procedures and schedules involved in operating, troubleshooting, servicing, and preventive maintaining of the system. Provide a minimum of 8 hours' training.
3. Schedule training with the Owner at least seven days in advance.

26-56 ARC FLASH REQUIREMENTS:

- a) The electrical contractor shall be responsible for all calculations and labeling of devices for arc flash hazard as required by NEC and NFPA and compliance with OSHA. Include all field work for verification of existing conditions, wire lengths, overcurrent ratings, load current, etc as well as same information for installation for any new panels installed under this contract.

END OF DIVISION 26

DIVISION 27 – COMMUNICATIONS AND SECURITY

27-1 CONTRACT DOCUMENTS

- a) All contract documents including drawings, alternates, addenda, and modifications preceding this Specification Division are applicable to Electrical Contractor and Communications contractor and additional subcontractors and material suppliers.

27-2 SPECIFICATION FORM AND DEFINITIONS:

- a) These Specifications are abbreviated form and contain incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as noted on the drawings,” “according to the drawings,” “a,” “an,” “the,” and “all” are intentional. Omitted words and phrases shall be supplied by inference.
- b) When a word such as “proper,” “satisfactory,” “equivalent,” and “as directed” is used, it requires Engineer’s review.
- c) “Provide” means furnish and install.
- d) “Working Day” wherever used in these Specifications, shall mean the normal working days Monday through Friday, exclusive of Saturday, Sunday, and federally observed holidays.
- e) Architect/Engineer hereinafter abbreviated A/E shall mean both the Design Architects and the Design Engineers.
- f) Design Engineer hereinafter abbreviated D/E shall mean the engineering firm, RTM Engineering Consultants LLC., 3333 E. Battlefield Suite 1000 Springfield, MO 65804, Telephone (417) 881-0020. Contact Person: Anthony G. Beier.
- g) General Contractor hereinafter abbreviated G/C shall mean the person or company and their subcontractors who enter into contract with the Owner to perform the general division work.
- h) Electrical Contractor hereinafter abbreviated E/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the electrical division work.
- i) Mechanical Contractor hereinafter abbreviated M/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the mechanical division work.
- j) Communication Contractor hereinafter abbreviated C/C shall mean the person or company and their subcontractors who enter into contract with the G/C to perform the division 27 IT and special systems work.
- k) Equipment and/or materials manufacturer hereinafter abbreviated E/M shall mean the manufacturer of equipment or materials specified or referred to.
- l) For purposes of clarity, the following systems will be covered under this section. All work unless otherwise indicated shall be included as an bid/allowance under the G/C. All work to be included shall be totally inclusive to designated vendors other than rough-in and 120V power (by E/C) unless otherwise indicated. G/C shall include work within the construction contract direct.
 - 1. Data System including wireless access points.
 - 2. Intercom System
 - 3. Access Control
 - 4. Security cameras

27-3 SUMMARY OF WORK:

a) Data System:

1. IT Contractor (TechTree) shall provide all CAT 6 horizontal cabling, fiber optic cabling, racks, jacks, cover plates, and all data terminal devices at point of use including termination at each end and documented testing and certification. Provide patch panels, fiber panels, wireless access points, UPS's, PoE switches, enclosures, and central equipment per owner's standard school requirements.
2. All fiber and multi-pair cable, connectors, etc. required for connection of new data systems, including fiber cabling between existing High School system and new auditorium addition data rack shall be provided by IT contractor.
3. IT Contractor shall provide all racks, panels, cable management components, mounting hardware, and all accessories per owner's standard school requirements.
4. IT Contractor shall provide all Wi-Fi system cabling, jacks, termination, and all accessories. E/C shall provide all rough-in and 120V power.
5. IT Contractor shall include CAT6 cable to each device location (data, phone, security cameras, and WAP) with 10' service whip.
6. Wi-Fi system shall be network controlled via a central controller located at the data closet location. All components shall be networked via data cabling and powered via new owner provided equipment.
7. IT Contractor shall be Techtree Partners. Contact: Devin Didier (417) 761-1854, devin.didier@techtreepartners.com

b) Access Control

1. Provide new card access system including devices, components, equipment, and programming as required.
2. Access control contractor (TechTree) shall include all low voltage, multi-conductor cable, or other cable to each device location and provide all required equipment connections.
3. Vendor shall coordinate specification and installation requirements with owner.
4. New system shall integrate with existing system in High School.
5. Vendor shall be Techtree Partners. Contact: Devin Didier (417) 761-1854, devin.didier@techtreepartners.com

c) Security Camera system

1. Provide new cameras, devices, components, and programming as required to extend security camera system into addition as shown on drawings.
2. Security Contractor (American Digital Security) shall include all equipment including all required connections and all other work for cameras noted below. CAT6 cable by IT contractor as noted above.
3. New cameras shall integrate with existing security camera system in High School.
4. Vendor shall coordinate specification and installation requirements with owner.

5. Vendor shall be American Digital Security. Contact: Chris Williams (816) 415-4237, chris.williams@americandigitalsecurity.com

d) Intercom System

1. Provide new speakers, low voltage wiring, call stations, devices, components, and programming as required to extend intercom system into addition as shown on drawings.
2. New equipment shall integrate with existing intercom system in High School.
3. Intercom Contractor (TechTree) shall include all cabling and connections to each speaker and call station. All other work for intercom system noted below.
4. Vendor shall coordinate specification and installation requirements with owner.
5. Vendor shall be Techtree Partners. Contact: Devin Didier (417) 761-1854, devin.didier@techtreepartners.com

27-4 GENERAL EXTENT OF WORK:

- a) Provide systems indicated on drawings, specified, or reasonably implied. Provide every device and accessory for proper operation and completion of all systems. In no case will claims for "Extra Work" be allowed for work about which contractor could have informed himself before bids were taken.
- b) Contractor shall familiarize himself with equipment provided by other contractors, which require electrical connections and controls. All work shall comply with Division 26.
- c) Contractor shall be responsible for compliance with all owner installation and specification items included at the end of this specification section.

27-5 COMMON WORK RESULTS FOR COMMUNICATION SYSTEMS:

- a) General: All work shall comply with the general construction, installation, and general building requirements in Specification 26.
- b) The IT contractor shall include all required phone and data connections for fire alarm panels, DDC control system, BAS control system, lighting control system, and security system.
- c) All components and wiring shall be installed in accordance with BICSI installation guidelines and per all owner requirements.

27-6 COMMUNICATION COORDINATION:

a) Coordination work by C/C:

1. Coordinate layout and installation of communications equipment with Owner's telecommunications and LAN equipment and service suppliers.
 - A. Meet with telecommunications and LAN equipment suppliers, G/C, E/C, and Owner to exchange information and agree on details of equipment arrangements and installation interfaces.
 - B. Record agreements reached in meetings and distribute them to other participants.
 - C. Adjust arrangements and locations of distribution frames, cross-connects, and patch panels in equipment rooms to accommodate and optimize arrangement and space requirements of telephone switch and LAN equipment.

- D. Installation of equipment for grounding provided by E/C.
- E. Meet and coordinate equipment requirements with owner and on-site contractor to ensure coordinated installations for construction schedules and space requirements.
- F. IT contractor to provide all backboards in IT rooms: Plywood, fire-retardant treated, painted, B-C exterior grade 5, 0.75", from 2' AFF to 6' AFF on one wall per owner's direction. Verify location prior to installation.

b) Execution:

1. Installation:

- A. Comply with NECA 1.
- B. Comply with BICSI TDMM for layout and installation of communications equipment rooms.
- C. Bundle, lace, and train conductors and cables to terminal points without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

2. Grounding:

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter. Provide all additional wire and connector for connection to ground bus bars provided by the E/C.
- B. Comply with ANSI-J-STD-607-A.

27-7 TELECOMMUNICATIONS CABLING SYSTEM:

- a) All cabling shall be plenum rated and shall be installed in manner as designated by BICSI installation guidelines. All cables shall be supported by contractor supplied j-hooks. Wiring installed through structural elements will NOT be approved without written owner or A/E approval prior to installation. All length shall be limited to 295' including slack loops. Contact A/E if any lengths will be exceeded.
- b) Install cables in raceways except within consoles cabinets desks and counters. Conceal all raceways except where noted on plans or where noted by A/E.
- c) Terminate all conductors; no cable shall contain unterminated elements.
- d) Cables may not be spliced. Secure and support cables at intervals not exceeding 30" and not more than 6" from cabinets, boxes, fittings, outlets, racks, frames, and terminals. Provide 10' service loop at terminations unless otherwise indicated in other sections of owner specifications.
- e) Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems". Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- f) Suspend cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 60 inches apart. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- g) IT Contractor shall be responsible for all testing and certification per BICSI standards.

END OF DIVISION 27

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees and vegetation to remain.
 - 2. Removing existing trees and vegetation.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above-grade and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place.
 - 7. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Temporary Facilities and Controls" for temporary utilities, temporary construction and support facilities, temporary security and protection facilities.
 - 2. Division 01 Section "Execution" for verifying utility locations and for recording field measurements.
 - 3. Division 31 Section "Earth Moving" for soil materials, excavating, backfilling, and site grading.

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Prior to commencing work the Contractor must submit photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings, according to Division 01 Section "Contract Closeout."
 - 1. Coordinate with Owner to identify and accurately locate capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management."

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by Owner and/or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property shall be obtained by Owner before beginning of said work.
 - 1. Do not proceed with work on adjoining property until directed by Owner.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- D. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.

- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain or to be relocated.
- D. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to the Missouri DNR Land Disturbance Permit criteria. See plans and project SWPPP for additional requirements.
- B. Contractor shall be fully responsible for continued monitoring until such time the Missouri DNR Land Disturbance Permit has been terminated.
- C. Repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established in accordance with Owner provided inspections.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- E. Contractor shall not proceed with installation of erosion and sedimentation control measures on adjacent properties not owned by the Owner until directed to do so by the Owner.

3.3 TREE PROTECTION

- A. Mark and identify drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within fenced area.

2. Do not permit vehicles, equipment, or foot traffic within fenced area.
 3. Maintain fenced area free of weeds and trash.
- B. Do not excavate within tree protection zones, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
1. Cover exposed roots with burlap and water regularly.
 2. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Owner.
1. Replace trees that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

3.4 UTILITIES

- A. Contractor will arrange for disconnecting and sealing indicated utilities, as preapproved by the owner that serve existing structures before site clearing, when requested by Contractor.
1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Contractor shall locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
1. Arrange with utility companies to shut off indicated utilities.

- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Architect not less than 14 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
- D. Excavate for and remove underground utilities indicated to be removed. Coordinate with Divisions 21, 22, 23, 26, 27, and 28 Sections.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps roots, obstructions, and debris extending to a depth of 18 inches below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
 - 5. Contractor shall be responsible for removal of cleared/grubbed material. If material is to be burned onsite, Contractor shall obtain any required permits necessary by the Village of Airport Drive.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.

- B. Strip topsoil to whatever depths is encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 - 1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, rock, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Limit height of topsoil stockpiles as directed by Owner and/or authorities having jurisdiction.
 - 2. Do not stockpile topsoil within drip line of trees to remain.
 - 3. Dispose of excess topsoil as specified for waste material disposal.
 - 4. Stockpile surplus topsoil to allow for respreading. At completion of Mass Grading, stripped topsoil shall be redistributed in all areas not specified to receive other surfaces to a minimum depth of 4 inches unless specified otherwise the by the Landscape Architect.

3.7 SITE IMPROVEMENTS

- A. Remove existing above-grade and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 - 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Geotechnical Study prepared for this project. If conflicts arise between the Specifications and the Geotechnical Study, the Engineer shall be contacted prior to construction.
- C. Regulatory authority's rules, regulations and specifications apply to this section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and plantings.
 - 2. Excavating and backfilling for buildings and structures.
 - 3. Drainage course for slabs-on-grade.
 - 4. Subbase course for concrete walks, pavements.
 - 5. Subbase course for asphalt paving.
 - 6. Excavating and backfilling for trenches within building lines.
 - 7. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
- B. Related Sections include the following:
 - 1. Division 01 Section "Unit Prices" for a schedule of unit prices.

2. Division 01 Section "Construction Facilities and Temporary Controls."
3. Division 31 Section "Site Clearing" for site stripping, grubbing, removal topsoil, and protective trees to remain.
4. Division 31 Section "Dewatering" for lowering and disposing of ground water during construction.
5. Division 03 Section "Cast-in-Place Concrete" for granular course over vapor retarder.
6. Divisions 21, 22, 23, 26, 27, 28 Sections for excavating and backfilling buried mechanical and electrical utilities and buried utility structures.

1.3 UNIT PRICES

- A. Rock Measurement: Volume of rock actually removed, measured in original position, but not to exceed the following.
1. 24 inches outside of concrete forms other than at footings.
 2. 12 inches outside of concrete forms at footings.
 3. 6 inches of minimum required dimensions of concrete cast against grade.
 4. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 5. 6 inches beneath bottom of concrete slabs-on-grade.
 6. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches Unit prices for rock excavation include replacement with approved materials.

1.4 DEFINITIONS

- A. Backfill: Soil material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Layer placed between the subbase course and asphalt paving.
- C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Suitable soil imported from off-site for use as fill or backfill.

- E. Drainage Course: Layer supporting the slab-on-grade used to minimize upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations as directed by Architect. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. LVC: Low Volume Change Material.
- I. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material 3/4 cu. yd. or more in volume that exceed a standard penetration resistance of 100 blows/2 inches when tested by an independent geotechnical testing agency, according to ASTM D 1586.
- J. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- K. Subbase Course: Course placed between the subgrade and base course for asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or walk.
- L. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- M. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Each type of plastic warning tape.
 - 2. Drainage fabric
 - 3. Separation fabric

- B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
 - 2. All borrow material sources and onsite top-soils shall be documented prior to hauling or placing, and submitted to the Owner for approval.
 - 3. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

- C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.6 QUALITY ASSURANCE

- A. Blasting: Is not allowed

- B. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.

- C. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings."

1.7 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Owner not less than 14 days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Contact utility-locator specified, as specified by Owner, for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Dust Control –
 - 1. Minimize the amount of time the site is left cut or exposed, plan earth moving works so they are completed just prior to the time they are needed.
 - 2. Observe weather conditions and do not commence or continue earthmoving works if conditions are unsuitable.
 - 3. Reduce off-site hauling via balanced cut and fill procedures.
 - 4. Pre-water, if possible, the areas marked for disturbance and the material that is being moved.
- D. Dust Control – Site Traffic Control:
 - 1. Provide directions and instructions relating to traffic movement within the site:
 - 2. Post signage, erect fencing and place barriers to direct traffic.
 - 3. Designate specific routes for hauling and access.
 - 4. Allocate off-site parking with on-site access only under special circumstances.
 - 5. Restrict public access onto the construction site when earthwork is exposed to traffic.
 - 6. Set and enforce a maximum speed limit, e.g. 10mph.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient Suitable soil materials are not available from excavations.

- B. Suitable Soils: As identified in the Geotechnical Report
- C. Unsuitable Soils: As identified in the Geotechnical Report
- D. LVC: As identified in the Geotechnical Report.
- E. Backfill and Fill: Suitable soil materials.
- F. Base Course: MoDOT Type 5
- G. Engineered Fill: As identified in the Geotechnical Report
- H. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- I. Drainage Fill: ASTM C-33, #57 Stone
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
- L. Borrow Material: As identified in the Geotechnical Report.

2.2 GEOTEXTILES

- A. As specified on the plans

2.3 CONTROLLED LOW-STRENGTH MATERIAL

- A. Controlled Low-Strength Material: Low-density, self-compacting, flowable concrete material as follows:
 - 1. Portland Cement: ASTM C 150, Type I.
 - 2. Fly Ash: ASTM C 618, Class C or F.
 - 3. Normal-Weight Aggregate: ASTM C 33, 3/8-inch nominal maximum aggregate size.
 - 4. Foaming Agent: ASTM C 869.

5. Water: ASTM C 94/C 94M.
 6. Air-Entraining Admixture: ASTM C 260.
- B. Produce low-density, controlled low-strength material with the following physical properties:
1. As-Cast Unit Weight: 30 to 36 lb/cu. Ft at point of placement, when tested according to ASTM C 138/C 138M.
 2. Compressive Strength: 80 psi, when tested according to ASTM C 495.
- C. Produce conventional-weight, controlled low-strength material with 80-psi compressive strength when tested according to ASTM C 495.

2.4 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 ENVIRONMENTAL SOIL MONITORING.

- A. Prior to reaching minus 2 1/2 feet from finish grade AND upon completion of grading activities, the contractor shall coordinate with the Barry County Health Department for scheduling of soil sampling to insure in-situ and borrow soils are within the county's limits for heavy metals. The contractor shall provide adequate time to allow the county time to schedule the testing and for the county to develop the results. Should tests indicate inadequate soils, the contractor shall remediate these at no additional cost.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.
- C. Provide erosion-control measures to prevent erosion of displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.4 EXPLOSIVES

- A. Explosives: Not allowed

3.5 EXCAVATION, GENERAL

- A. Over-Excavation: Refer to the geotechnical report for areas to be over-excavated to remove uncontrolled or unsuitable soils.

- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by Architect. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract Time may be authorized for rock excavation.
1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling: blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs-on-grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.6 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.7 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.8 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 1. Clearance: As indicated.
- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.
 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.9 SUBGRADE INSPECTION

- A. Notify Architect when excavations have reached required subgrade.
- B. If Architect determines that unsuitable soil is present, continue excavation and replace with compacted backfill or fill material as directed.
 - 1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- C. Proof-roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect/Engineer.

3.10 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.11 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated Suitable soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 2. Surveying locations of underground utilities for Record Documents.
 3. Testing and inspecting underground utilities.
 4. Removing concrete formwork.
 5. Removing trash and debris.
 6. Removing temporary shoring and bracing, and sheeting.
 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.13 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete."
- D. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.
1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the utility pipe or conduit.
- G. Backfill voids with Suitable soil while installing and removing shoring and bracing.

- H. Place and compact final backfill of Suitable soil to final subgrade elevation.
- I. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.
- J. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.14 FILL

- A. Refer to the Geotechnical Report for requirements for fill placement and allowable fill materials.
- B. Low Volume Change (LVC) material: Refer to the Geotechnical Report for acceptable LVC materials.
- C. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- D. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use Suitable soil material.
 - 2. Under walks and pavements, use Suitable soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- E. Place fill on subgrades free of mud, frost, snow, or ice.

3.15 MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within limits identified in the geotechnical report.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace or scarify and air dry otherwise Suitable soil material that exceeds optimum moisture and is too wet to compact to specified dry unit weight.

3.16 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:
 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.17 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 1. Provide a smooth transition between adjacent existing grades and new grades.
 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Mass Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades as indicated on plans.

3.18 SUBSURFACE DRAINAGE

- A. Subsurface Drain: As specified on the plans

3.19 SUBBASE AND BASE COURSES

- A. Under pavements and walks, place subbase course on prepared subgrade and as follows:
 - 1. Place base course material over subbase.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 4. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
 - 5. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.

3.20 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. Under cast-in-place concrete slabs-on-grade, place drainage course on prepared subgrade and as follows:
 - 1. When compacted thickness of drainage course is 6 inches or less, place materials in single layer.
 - 2. When compacted thickness of drainage course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.
 - 3. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent (or as recommended in the Geotechnical Report) of maximum dry unit weight according to ASTM D 698.

3.21 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 - 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2500 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests per lift.
 - 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 - 3. Trench Backfill: At each compacted initial and final backfill layer, at least 1 test for each 300 feet or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.22 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.23 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus Suitable soil and waste material, including unsuitable soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 312319- DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes construction dewatering.
- B. Related sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
 - 2. Division 31 Section "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
 - 1. Delegated Design: Design dewatering system, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
 - 2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 - 3. Prevent surface water from entering excavations by grading, dikes, or other means.
 - 4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
 - 5. Remove dewatering system when no longer required for construction.

1.4 SUBMITTALS

- A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.

1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
 2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.
- B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Qualification Data: For qualified Installer and professional engineer.
- D. Field Quality-Control Reports.
- E. Other informational submittals:
1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.
- B. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.6 PROJECT CONDITIONS

- A. Interruption of existing utilities: Do not interrupt any utility serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:
1. Notify Architect no fewer than 7 days in advance of proposed interruption of utility.
 2. Do not proceed with interruption of utility without Architect's written permission.
- B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for dewatering.
 2. The geotechnical report is included elsewhere in the Project Manual.

- C. Survey Work: Engage a qualified land surveyor or professional engineer to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 - 1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system TO ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- C. Provide temporary grading to facilitate dewatering and control of surface water.
- D. Monitor dewatering systems continuously.
- E. Promptly repair damages to adjacent facilities caused by dewatering.
- F. Protect and maintain temporary erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing" during dewatering operations.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
 - 1. Space well points or wells at intervals required to provide sufficient dewatering.
 - 2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
 - 1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.
- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

3.3 FIELD QUALITY CONTROL

- A. Observation Wells: Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers indicated; additional observation wells may be required by authorities having jurisdiction.
 - 1. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
 - 2. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. In areas where observation wells are not functioning properly, suspend construction activities until reliable observations can be made. Add or remove water from observation-well risers to demonstrate that observation wells are functioning properly.
 - 3. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

- B. Provide continual observation to ensure that subsurface soils are not being removed by the dewatering operation.

END OF SECTION

SECTION 313116 - TERMITE CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Chemical soil treatment.

1.2 REFERENCE STANDARDS

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act 2019.

1.3 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Include the EPA Registered Label for termiticide products.
- D. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.4 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide three year installer's warranty against damage to building caused by termites.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain termite control products from single source from single manufacturer.

2.2 CHEMICAL SOIL TREATMENT

- A. Toxicant Chemical: EPA Title 7, United States Code, 136 through 136y approved; synthetically color dyed to permit visual identification of treated soil.
- B. Manufacturers:
 - 1. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle. Bayer Environmental Science Corp; ____: www.backedbybayer.com/pest-management/#sle.
 - 2. BASF Corporation
 - 3. Ensystem, Inc.
- C. Mixes: Mix toxicant to manufacturer's instructions.
- D. Service Life of Treatment: Soil treatment termiticide that is effective for not less than three years against infestation of subterranean termites.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.2 PREPARATION

- A. General: Prepare work areas according to the requirements of authorities having jurisdiction and according to manufacturer's written instructions before beginning application and installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

3.3 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
 - B. Application: Mix soil treatment termiticide solution to a uniform consistency. Distribute treatment uniformly. Apply treatment at the product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.
 - C. Apply toxicant at following locations:
 - 1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
 - 2. Foundations: Soil adjacent to and along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing.
 - D. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
 - E. Re-treat disturbed treated soil with same toxicant as original treatment.
 - F. If inspection or testing identifies the presence of termites, re-treat soil and re-test.
 - G. Post warning signs in areas of application
- 3.4 PROTECTION**
- A. Do not permit soil grading over treated work.
 - B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

END OF SECTION

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Asphalt surface treatments.
5. Pavement-marking paint.

- B. Related Sections:

1. Division 31 Section "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
2. Division 32 Sections for other paving installed as part of crosswalks in asphalt pavement areas.
3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
 - 1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
 - 2. Job-Mix Designs: For each job mix proposed for the Work.
- B. Qualification Data: For qualified manufacturer.
- C. Material Certificates: For each paving material from manufacturer.
- D. Material Test Reports: For each paving material.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by the DOT of state in which Project is located.

- B. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.
- C. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the DOT of state in which Project is located for asphalt paving work.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.
- D. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
 - a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 - b. Review condition of subgrade and preparatory work.
 - c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 - d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 40 deg F.
 - 2. Slurry Coat: Comply with weather limitations in ASTM D 3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

- B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.

- B. Coarse Aggregate: AASHTO T92 (50% loss max), AASHTO T85 (4% adsorption max) and sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

- C. Fine Aggregate: Sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof in accordance with MODOT specifications.
 - 1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

- D. Mineral Filler: Rock or limestone dust, hydraulic cement, or other inert material meeting AASHTO T37 and conforming to the following gradation:

- E. Passing No. 30 Sieve 100
- F. Passing No. 50 Sieve 95-100
- G. Passing No. 100 Sieve 90-100
- H. Passing No. 200 Sieve 70-100

2.2 ASPHALT MATERIALS

- A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22
- B. Asphalt Cement: ASTM D 3381 for viscosity-graded material.
- C. Tack Coat: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application. Grade SS-1 or SS-1H.
- D. Fog Seal: AASHTO M 140 emulsified asphalt, or AASHTO M 208 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

- E. Water: Potable.
- F. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

- A. Sand: AASHTO M 29, Grade Nos. 2 or 3.
- B. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- C. Joint Sealant: ASTM D 6690 Type II hot-applied, single-component, polymer-modified bituminous sealant.
- D. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
 - 1. Color: Yellow: Chip # 33538

- E. Wheel Stops: As specified on the plans

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by MoDOT.
 - 1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
 - 2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
 - a. Asphaltic Base Course: MoDOT Base
 - b. Asphaltic Surface Course: MoDOT BP-2
- B. Emulsified-Asphalt Slurry: ASTM D 3910, Grad SS-1 or SS-1H.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to begin paving.

- B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 - 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 - 2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 - 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- C. Proceed with paving only after unsatisfactory conditions have been corrected.
- D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 COLD MILLING

- A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.
 - 1. Mill to a depth of 1-1/2 inches.
 - 2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
 - 3. Control rate of milling to prevent tearing of existing asphalt course.
 - 4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
 - 5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
 - 6. Transport milled hot-mix asphalt to asphalt recycling facility.
 - 7. Keep milled pavement surface free of loose material and dust.

3.3 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.
- D. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.4 REPAIRS

- A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
 - 1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.
- B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/2 inch.
 - 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 - 2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
 - 3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.5 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
- B. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd..
 - 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.6 PAVING GEOTEXTILE INSTALLATION

- A. Section not used.

3.7 HOT-MIX ASPHALT PLACING

- A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
 - 2. Place hot-mix asphalt surface course in single lift.
 - 3. Spread mix at minimum temperature of 250 deg F.
 - 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

- B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.8 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
 - 6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.9 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to AASHTO T 245, but not less than 94 percent nor greater than 100 percent.
 2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.10 ASPHALT CURBS

- A. Section not used

3.11 ASPHALT TRAFFIC-CALMING DEVICES

- A. Section not used

3.12 INSTALLATION TOLERANCES

- A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
1. Base Course: Plus or minus 1/2 inch.
 2. Surface Course: Plus 1/4 inch, no minus.

- B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.
- C. Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.13 SURFACE TREATMENTS

- A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.
- B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
 - 1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.14 PAVEMENT MARKING

- A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.
- B. Allow paving to age for 28 days before starting pavement marking.

- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.15 WHEEL STOPS

- A. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.16 PREFORMED TRAFFIC-CALMING DEVICES

- A. Section not used

3.17 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
- C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
 2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
 - a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
 - b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
- E. Replace and compact hot-mix asphalt where core tests were taken.
- F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.18 DISPOSAL

- A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
1. Do not allow milled materials to accumulate on-site.

END OF SECTION

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes exterior cement concrete pavement for the following:
 - 1. Driveways and roadways.
 - 2. Parking lots.
 - 3. Curbs and gutters.
 - 4. Walkways.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for general building applications of concrete.
 - 2. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
 - 3. Division 32 Section "Concrete Paving Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.

1.3 DEFINITIONS

- A. Cementitious Materials: Per MoDOT Specifications

1.4 SUBMITTALS

- A. Product Data: For each type of manufactured material and product indicated.
- B. Concrete Pavement Joint Plan: Contractor shall submit to the Engineer for approval proposed jointing plan. Plan shall be submitted no later than 4 weeks prior to concrete pavement placement. Plan shall include proposed location of all construction, isolation, and contraction joints.
- C. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
 - 1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
- E. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:
 - 1. Cementitious materials.
 - 2. Steel reinforcement and reinforcement accessories.
 - 3. Fiber reinforcement.
 - 4. Admixtures.
 - 5. Curing compounds.
 - 6. Bonding agent or epoxy adhesive.
 - 7. Joint fillers.

- F. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
 - 1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
 - 1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
- C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.
- D. Concrete Testing Service: The owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete producer.
 - d. Concrete pavement subcontractor.

1.6 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves with a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed.
- B. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
 - 1. Portland Cement: ASTM C 150, Type I, gray. Fly Ash or Blast Furnace Slag blends per MoDOT Specifications

- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source with documented MoDOT inspection record.
 - 1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
 - 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Exposed Aggregate: Selected, hard, and durable; washed; free of materials with deleterious reactivity to cement or that cause staining; from a single source, with gap-graded coarse aggregate as follows:
 - 1. Aggregate Sizes: 1/2 to 3/4 inch nominal.
 - 2. Aggregate Source, Shape, and Color: As determined by the architect.
- D. Water: ASTM C 94/C 94M.
- E. Air-Entraining Admixture: ASTM C 260.
- F. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 FIBER REINFORCEMENT

- A. Synthetic Fiber: When shown on the drawings provide Monofilament or fibrillated polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

1. Available Products:

a. Monofilament Fibers:

- 1) Axim Concrete Technologies; Fibrasol IIP.
- 2) Euclid Chemical Company (The); Fiberstrand 100.
- 3) FORTA Corporation; Forta Mono.
- 4) Grace, W. R. & Co.--Conn.; Grace MicroFiber.
- 5) Metalcrete Industries; Polystrand 1000.
- 6) SI Concrete Systems; Fibermix Stealth.

2.6 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

1. Available Products:

- a. Axim Concrete Technologies; Cimfilm.
- b. Burke by Edeco; BurkeFilm.
- c. ChemMasters; Spray-Film.
- d. Conspec Marketing & Manufacturing Co., Inc.; Aquafilm.

- e. Dayton Superior Corporation; Sure Film.
- f. Euclid Chemical Company (The); Eucobar.
- g. Kaufman Products, Inc.; Vapor Aid.
- h. Lambert Corporation; Lambco Skin.
- i. L&M Construction Chemicals, Inc.; E-Con.
- j. MBT Protection and Repair, ChemRex Inc.; Confilm.
- k. Meadows, W. R., Inc.; Sealtight Evapre.
- l. Metalcrete Industries; Waterhold.
- m. Nox-Crete Products Group, Kinsman Corporation; Monofilm.
- n. Sika Corporation, Inc.; SikaFilm.
- o. Symons Corporation; Finishing Aid.
- p. Vexcon Chemicals, Inc.; Certi-Vex EnvioAssist.

E. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

1. Available Products:

- a. Anti-Hydro International, Inc.; AH Curing Compound #2 WP WB.
- b. Burke by Edoco; Resin Emulsion White.
- c. ChemMasters; Safe-Cure 2000.
- d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
- e. Dayton Superior Corporation; Day-Chem White Pigmented Cure (J-10-W).
- f. Euclid Chemical Company (The); Kurez VOX White Pigmented.
- g. Kaufman Products, Inc.; Thinfilm 450.
- h. Lambert Corporation; Aqua Kure-White.
- i. L&M Construction Chemicals, Inc.; L&M Cure R-2.
- j. Meadows, W. R., Inc.; 1200-White.
- k. Symons Corporation; Resi-Chem White.
- l. Tamms Industries, Inc.; Horncure 200-W.
- m. Unitex; Hydro White.
- n. Vexcon Chemicals, Inc.; Certi-Vex Enviocure White 100.

2.7 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or preformed polypropylene joint filler.
- B. Color Pigment: Refer to the plans and manufactures specifications
- C. Slip-Resistive Aggregate Finish: Section not used
- D. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- E. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:
 - 1. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- F. Chemical Surface Retarder: Water-soluble, liquid-set retarder with color dye, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch.
 - 1. Available Products:
 - a. Burke by Edeco; True Etch Surface Retarder.
 - b. ChemMasters; Exposee.
 - c. Conspec Marketing & Manufacturing Co., Inc.; Delay S.
 - d. Euclid Chemical Company (The); Surface Retarder S.
 - e. Kaufman Products, Inc.; Expose.
 - f. Metalcrete Industries; Surfard.
 - g. Nox-Crete Products Group, Kinsman Corporation; Crete-Nox TA.
 - h. Scofield, L. M. Company; Lithotex.
 - i. Sika Corporation, Inc.; Rugasol-S.
 - j. Vexcon Chemicals, Inc.; Certi-Vex Envioset.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.
- B. Proportion mixtures to provide normal-weight concrete with the following properties:
 - 1. Mix design shall correspond to MoDOT Class B-1 concrete, air-entrained.
- C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:
 - 1. Air Content: 6.5 percent plus or minus 1.5 percent.
- D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use plasticizing and retarding admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
- F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals.] as follows:

1. Fly Ash or Pozzolan: Per MoDOT Specifications

2.9 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.
 1. When air temperature is between 85 deg F and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For concrete mixes of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
 2. For concrete mixes larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

- B. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
 - 1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
 - 2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
 - 3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1 require correction according to requirements in Division 31 Section "Earth Moving."
- C. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.2 PREPARATION

- A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.
1. Doweled Joints: Install 1"x18" dowel bars and support assemblies at all construction joints. Dowels shall be spaced at 24" OC. Lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.
- C. Isolation Joints: Form isolation joints of preformed $\frac{3}{4}$ " joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 50 feet, unless otherwise indicated.
 2. Extend joint fillers full width and depth of joint.
 3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
 4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
 5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
 6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

- D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated or spaced no more than 12 feet from one another. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:
 - 1. Doweled Contraction Joints: Install 1"x18" dowel bars and support assemblies at all bars and support assemblies at all contraction joints. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.
- E. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.
- C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.
- D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- E. Do not add water to concrete during delivery or at Project site.
- F. Do not add water to fresh concrete after testing.

- G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.
- I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.
 - 1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.
- J. Screed pavement surfaces with a straightedge and strike off.
- K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.
- L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.
- M. Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.
 - 1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

- N. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.
- O. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 - 1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
 - 2. Do not use frozen materials or materials containing ice or snow.
 - 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.
- P. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:
 - 1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 - 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 - 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FLOAT FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared, and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.8 SPECIAL FINISHES

- A. Section not used.

3.9 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
 1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

- a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.10 PAVEMENT TOLERANCES

- A. Comply with tolerances of ACI 117 and as follows:
 1. Elevation: 1/4 inch.
 2. Thickness: Plus 3/8 inch, minus 1/4 inch.
 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/4 inch.
 4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
 5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
 6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
 7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
 8. Joint Spacing: 3 inches.
 9. Contraction Joint Depth: Plus 1/4 inch, no minus.
 10. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

- B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least 1 composite sample for each 5000 sq. ft. or fraction thereof of each concrete mix placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
 3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
 - a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.
- C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
- D. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

- E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.
- F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.
- G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.
- H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 321373 - CONCRETE PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.
 - 2. Joints between cement concrete and asphalt pavement.
- B. RELATED SECTIONS INCLUDE the following:
 - 1. Division 32 Section "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
 - 2. Division 32 Section "Concrete Paving" for constructing joints in concrete pavement.

1.3 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.
- B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- C. Compatibility and Adhesion to Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
 - 3. When joint substrates are wet or covered with frost.
 - 4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
 - 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.
- B. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 - 1. Products:
 - a. Crafcoc Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.

2.4 HOT-APPLIED JOINT SEALANTS

- A. Section not used.

2.5 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
- C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
- D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.6 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tolling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 331100 - WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes water-distribution piping and specialties outside the building for the following:
 - 1. Water services.
 - 2. Fire-service mains.
 - 3. Fire Hydrants
 - 4. Backflow preventers and assemblies
- B. Utility-furnished products include water meters that will be furnished to the site, ready for installation.

1.3 DEFINITIONS

- A. Combined Water Service and Fire-Service Main: Exterior water piping for both domestic-water and fire-suppression piping.
- B. Water-Distribution Piping: Interior domestic-water piping.
- C. Water Service: Exterior domestic-water piping.
- D. The following are industry abbreviations for plastic materials:
 - 1. PVC: Polyvinyl chloride plastic.

1.4 SUBMITTALS

- A. Product Data: For the following:

1. Piping specialties.
2. Valves and accessories.
3. Fire Hydrant assemblies.
4. Backflow preventers and assemblies.
5. Field Quality-Control Test Reports: From Contractor.

B. Operation and Maintenance Data: For specialties to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Closeout Procedures," include the following:

1. Fire Hydrants
2. Valves
3. Backflow preventers and assemblies

1.5 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles, and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1.6 REGULATORY REQUIREMENTS:

- A. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
- B. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
- C. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- D. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
- G. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- H. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
- I. NSF COMPLIANCE:

- J. Comply with NSF 14 for plastic potable-water-service piping
- K. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - B. Ensure that valves are dry and internally protected against rust and corrosion.
 - C. Protect valves against damage to threaded ends and flange faces.
 - D. Set valves in best position for handling. Set valves closed to prevent rattling.
- E. During Storage: Use precautions for valves, including fire hydrants, according to the following:
 - F. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - G. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
 - H. Handling: Use sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
 - I. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
 - J. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
 - K. Protect flanges, fittings, and specialties from moisture and dirt.
 - L. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.8 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

1.9 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:
 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the products specified.
 2. Products: Subject to compliance with requirements, provide one of the products specified.
 3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
 4. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, tube, fitting, and joining materials.

2.3 PVC PIPE AND FITTINGS

- A. PVC, AWWA Pipe: AWWA C900, Class 200, with bell end with gasket and spigot end.
- B. Comply with UL 1285 for fire-service mains if indicated.
- C. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
- D. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

2.4 JOINING MATERIALS

- A. Refer to Division 33 Section "Utility Materials" for commonly used joining materials.

2.5 TRANSITION COUPLINGS:

- A. Underground Piping, NPS 2 and Larger: AWWA C219, metal, sleeve-type coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Plastic Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

2.6 CORROSION-PROTECTION ENCASEMENT FOR PIPING

- A. Encasement for Underground Metal Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch minimum thickness, tube or sheet.

2.7 GATE VALVES

- A. Acceptable Manufacturers:
 - 1. Mueller
 - 2. Clow
- B. All gate valves shall conform to AWWA C509
- C. All gate valves shall be resilient seated type.
- D. All gate valves shall be non-rising stem type with triple "O" - Ring seals. The top two "O"-Rings shall be field replaceable without removing the valve from service.

2.8 WATER METERS

- A. Water meters will be furnished by utility company.

2.9 WATER-METER BOXES

- A. As specified on the plans.

2.10 BACKFLOW PREVENTERS

- A. Available Manufacturers:

1. Watts Industries, Inc.; Water Products Div. (4" & 8" - 709DCDA Double Check Detector Assembly)
2. Or approved equal

2.11 CONCRETE VAULTS

- A. Description: Precast, reinforced-concrete vault, designed for A-16 load designation according to ASTM C 857 and made according to ASTM C 858.
- B. Manhole: ASTM A 48, Class No. 35 (ASTM A 48M, Class No. 250) minimum tensile strength, gray-iron traffic frame and cover.
- C. Dimensions: Not smaller than 24-inch diameter, unless otherwise indicated.
- D. Manhole: ASTM A 536, Grade 60-40-18, ductile-iron, 24-inch- minimum-diameter traffic frame and cover.

2.12 PROTECTIVE ENCLOSURES

- A. Valve Boxes:
- B. Acceptable Manufacturers:
 1. Clow Corporation
 2. Mueller Company
- C. Provide for all buried valves.
- D. Design:
 1. Boxes shall be three-piece cast-iron slide type with 5-1/4-inch shaft.
 2. Provide extension stem to bring operating nut within 3 feet of valve box top.
 3. Drop cover shall be marked "WATER".

2.13 FREESTANDING FIRE HYDRANTS

- A. Acceptable Model/Manufacturer:
 1. As indicated on the plans
- B. Fire hydrants shall conform to AWWA C502 for dry-barrel fire hydrants.
- C. Fire hydrants shall have a nominal 5-1/4 inch main valve with 6-inch mechanical joint inlet shoe connection.
- D. Outlet nozzles shall be National (American) fire hose coupling screw threads and be as follows:

1. Two - 2-1/2 inch hose nozzles
 2. One - 4-1/2 inch pumper nozzle.
- E. Main valve shall be equipped with "O"-ring seals and shall open to the left (counterclockwise).
- F. Fire hydrants shall be of the break-flange safety-top type.
- G. Fire hydrants shall be prime coated from the ground line up shall conform to Federal Spec TT-P-636 only. Federal Spec TT-P-86 is not acceptable. Coatings which contain more than 0.06% by weight of lead shall not be used. The hydrants shall be given a second coat of paint, from the ground line up paint shall be red in color for the barrel, the bonnett and caps will be painted according to the following table. The paint shall be equivalent to Sherwin Williams industrial enamel B54 series.

Hydrant Class	Flow of Hydrant in GPM	Color of Bonnet & Caps
		Sherwin Williams Industrial Enamel B54 Series
AA	1500 or Greater	Light Blue (Sherwin Williams Laser Blue SW4079)
A	1000-1499	Green (Sherwin Williams Safety Green SW4085)
B	500-999	Orange (Sherwin Williams Safety Orange SW4083)
C	Less than 500	Red (Sherwin Williams Safety Red SW4081)

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Refer to Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
- C. Do not use flanges, unions, or keyed couplings for underground piping.

- D. Flanges, unions, keyed couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground Water-Service Piping: Use any of the following piping materials for each size range:
 - 1. NPS 4 to NPS 8: PVC C900 pipe; push on gasketed joints, ductile-iron fittings.
- F. Underground Fire-Service-Main Piping: Use the following:
 - 1. NPS 4 to NPS 8: PVC C900 pipe listed for fire-protection service; push on gasketed joints, ductile-iron fittings.

3.3 VALVE APPLICATIONS

- A. As specified in Section 2.11.

3.4 JOINT CONSTRUCTION

- A. Joints:
- B. Push-On:
- C. Restrained:
- D. Provide restrained joint pipe where required.
- E. Provide restrained joints of following approved types:
 - 1. Restrained mechanical joint
 - 2. Restrained push-on joint.
 - 3. Boltless or bolted ball and socket joint.
 - 4. Anchored couplings.
- F. Provide retainer glands where required.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. See Division 33 Section "Utility Materials" for piping-system common requirements.

3.6 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.

- B. Comply with NFPA 24 for fire-service-main piping materials and installation.
- C. Install PE corrosion-protection encasement according to ASTM A 674 or AWWA C105.
- D. Install PVC, AWWA pipe according to AWWA M23 and ASTM F 645.
- E. Bury piping with depth of cover over top at least 42".
- F. Install piping by tunneling, jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
- G. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
- H. Anchor service-entry piping to building wall.
- I. See Division 22 for potable-water piping inside the building.

3.7 WATER-METER INSTALLATION

- A. Install water meters, piping, and specialties according to utility company's written requirements.

3.8 ROUGHING-IN FOR WATER METERS

- A. Rough-in piping and specialties for water-meter installation according to utility company's written instructions and requirements.

3.9 PROTECTIVE ENCLOSURE INSTALLATION

- A. Install protective enclosure over valves and equipment.
- B. Anchor protective enclosure to concrete base.

3.10 FIRE HYDRANT INSTALLATION

- A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.
- B. AWWA-Type Fire Hydrants: Comply with AWWA M17.

3.11 CONNECTIONS

- A. Piping installation requirements are specified in other Division 33 Sections. Drawings indicate general arrangement of piping and specialties.
- B. See Division 33 Section "Utility Materials" for piping connections to valves and equipment.
- C. Connect water-distribution piping to existing utility water main. Connection to be coordinated with utility.
- D. Connect water-distribution piping to interior domestic-water piping.

3.12 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.
- C. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare reports of testing activities.

3.13 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground water-service piping. Locate below finished grade, directly over piping. See Division 31 Section "Earth Moving" for underground warning tapes.
- B. Permanently attach equipment nameplate or marker, indicating plastic water-service piping, on main electrical meter panel. See Division 33 Section "Utility Materials" for identifying devices.

3.14 ADJUSTING

- A. Section not used.

3.15 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
- B. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
- C. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below:
- D. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
- E. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
- F. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
- G. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- H. Prepare reports of purging and disinfecting activities.
- I. After completing drinking fountain installation, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.
- J. Clean drinking fountains, on completion of installation, according to manufacturer's written instructions.

END OF SECTION

SECTION 334100 - UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes gravity-flow, nonpressure storm and sanitary drainage outside the building, with the following components:
 - 1. Cleanouts.
 - 2. No pressure drainage piping
 - 3. Concrete manholes junction boxes and inlets.

1.3 DEFINITIONS

- A. HDPE: High Density Polyethylene plastic.
- B. HP: Polypropylene
- C. PVC: Polyvinyl chloride plastic.
- D. RCP: Reinforced concrete pipe

1.4 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure, Drainage-Piping Pressure Rating: [10-foot head of water] Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

- A. Product Data: For the following:
 - 1. Special pipe fittings.
 - 2. Drains.
- B. Shop Drawings: For the following:
 - 1. Manholes and Junction Boxes: Include plans, elevations, sections, details, and frames and covers. Include design calculations, and concrete design-mix report for cast-in-place manholes.
 - 2. Catch Basins and Stormwater Inlets: Include plans, elevations, sections, details, and frames, covers, and grates.
 - 3. Stormwater Detention Structures: Include plans, elevations, sections, details, frames and covers, design calculations, and concrete design-mix report.
- C. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not store plastic pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe fittings, and seals from dirt and damage.
- C. Handle manholes according to manufacturer's written rigging instructions.
- D. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
 - 1. Notify Architect no fewer than two days in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Architect's written permission.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 PIPING MATERIALS

- A. Refer to Part 3 "Piping Applications" Article for applications of pipe, fitting, and joining materials.

2.3 DUCTILE-IRON CULVERT PIPE AND FITTINGS

- A. Section not used.

2.4 DUCTILE-IRON PRESSURE PIPE AND FITTINGS

- A. Section not used.

2.5 STEEL PIPE AND FITTINGS

- A. Section not used.

2.6 ALUMINUM PIPE AND FITTINGS

- A. Section not used.

2.7 ABS PIPE AND FITTINGS

- A. Section not used.

2.8 HDPE PIPE AND FITTINGS

- A. Corrugated HDPE Drainage Pipe and Fittings 4" through 60" (100 mm to 1500mm) AASHTO M 252M, with smooth waterway.
 - 1. Corrugated HDPE Pipe and Fittings NPS 8 to NPS 48: AASHTO M 294, with smooth waterway for coupling joints.
 - 2. Watertight Soiltight Couplings: AASHTO M 294, corrugated, matching pipe and fittings. Gaskets shall meet ASTM F477 and watertight according to ASTM D3212.

2.9 HP PIPE AND FITTINGS

- A. HP Drainage Pipe and Fittings 12" through 30" (100 mm to 1500mm) AASHTO M 252M, with smooth waterway meeting or exceeding ASTM F2736 & AASHTO M330.

2.10 PVC PIPE AND FITTINGS

- A. PVC Sewer Pipe and Fittings, NPS 15 and Smaller: ASTM D 3034, SDR 35, with bell-and-spigot ends for gasketed joints with ASTM F 477, elastomeric seals.

2.11 CONCRETE PIPE AND FITTINGS

- A. Section not used.

2.12 NONPRESSURE-TYPE PIPE COUPLINGS

- A. Section not used.

2.13 SPECIAL PIPE FITTINGS

- A. Section not used.

2.14 BACKWATER VALVES

- A. Section not used.

2.15 CLEANOUTS

- A. PVC Cleanouts: PVC body with PVC threaded plug. Include PVC sewer pipe fitting and riser to cleanout of same material as sewer piping.

- 1. Available Manufacturers:

- a. Canplas Inc.
 - b. IPS Corporation.
 - c. NDS Inc.
 - d. Plastic Oddities, Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Zurn Industries, Inc.; Zurn Light Commercial Specialty Plumbing Products.

- B. HDPE Cleanout: As specified on the plans

2.16 DRAINS

- A. Section not used.

2.17 CORROSION-PROTECTION PIPING ENCASEMENT

- A. Section not used.

2.18 MANHOLES

- A. As specified on the plans.

2.19 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318/318R, ACI 350R, and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.

- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water-cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water-cementitious materials ratio.
 - 1. Reinforcement Fabric: ASTM A 185, steel, welded wire fabric, plain.
 - 2. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.20 CATCH BASINS

- A. As specified on the plan.

2.21 STORMWATER INLETS

- A. As specified on the plans.

2.22 STORMWATER DETENTION STRUCTURES

- A. As specified on the plans.

2.23 PIPE OUTLETS

- A. As specified on the plans.

2.24 BELOW GROUND STORMWATER PIPE DETENTION SYSTEMS

- A. Section not used.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING APPLICATIONS

- A. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
 1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.

- a. Unshielded flexible or rigid couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible or rigid couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.
2. Use pressure-type pipe couplings for force-main joints.
- B. Special Pipe Fittings: Use for pipe expansion and deflection. Pipe couplings and special pipe fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- C. Gravity-Flow, Nonpressure Sewer Piping: Use any of the following pipe materials in the locations specified on the drawings for each size range:
- 1. NPS 4 and NPS 6: PVC sewer pipe and fittings, gaskets, and gasketed joints.
 - 2. NPS 4 and NPS 6: Corrugated HDPE drainage pipe and fittings, soiltight couplings, and coupled joints.
 - 3. NPS 8 and NPS 10 Corrugated HDPE pipe and fittings in soiltight couplings, and coupled joints.
 - 4. NPS 12 to NPS 18: HP pipe and fittings

3.3 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.
- F. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install HDPE corrugated sewer piping according to CPPA's "Recommended Installation Practices for Corrugated Polyethylene Pipe and Fittings."
 - 3. Install HP pipe according to ASTM D2321 and manufactures installation guidelines.
 - 4. Install PVC sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 5. Install PVC profile gravity sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 6. Install reinforced-concrete sewer piping according to ASTM C 1479 and ACPA's "Concrete Pipe Installation Manual."

3.4 PIPE JOINT CONSTRUCTION

- A. Basic pipe joint construction is specified in Division 33 Section "Common Work Results for Utilities." Where specific joint construction is not indicated, follow piping manufacturer's written instructions.
- B. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join corrugated HDPE piping according to CPPA 100 and the following:
 - a. Use watertight couplings.
 - 2. Join HP pipe with a gasket integral bell & spigot joint meeting the requirements of ASTM F2736 or F2881, for the respective diameters.
 - 3. 12- through 60-inch shall be watertight according to the requirements of ASTM D3212. Spigots shall have gaskets meeting the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 - 4. 12- through 60-inch diameters shall have a reinforced bell with a polymer composite band installed by the manufacturer.
 - 5. Join PVC sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric gasket joints.
 - 6. Join PVC profile gravity sewer piping according to ASTM D 2321 for elastomeric-seal joints or ASTM F 794 for gasketed joints.
 - 7. Join reinforced-concrete sewer piping according to ACPA's "Concrete Pipe Installation Manual" for rubber-gasket joints.

8. Join dissimilar pipe materials with nonpressure-type flexible couplings.

3.5 BACKWATER VALVE INSTALLATION

- A. Section not used.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extension from sewer pipe to cleanout at grade at locations shown on the drawings. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use heavy-duty, top-loading classification cleanouts in vehicle-traffic service areas other than street, roads and parking lots.
 2. Use extra-heavy-duty, top-loading classification cleanouts in streets, roads, and parking lot areas.
- B. Set cleanout frames and covers in cast-in-place concrete block, 18 by 18 by 12 inches deep. Set with tops 1 inch above surrounding earth grade.
- C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.7 DRAIN INSTALLATION

- A. Per manufactures specifications.

3.8 MANHOLE INSTALLATION

- A. General: Install manholes, complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections according to ASTM C 891.
- C. Construct cast-in-place manholes as indicated.
- D. Install FRP manholes according to manufacturer's written instructions.
- E. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere, unless otherwise indicated.

3.9 CATCH BASIN INSTALLATION

- A. Construct catch basins to sizes and shapes indicated.
- B. Set frames and grates to elevations indicated.

3.10 STORMWATER INLET [AND OUTLET] INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.11 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318/318R.

3.12 BELOW GROUND STORMWATER PIPE DETENTION SYSTEM INSTALLATION

- A. Section not used.

3.13 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section "Facility Storm Drainage Piping."

3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS

- A. Abandoned Piping: Close open ends of abandoned underground piping indicated to remain in place. Include closures strong enough to withstand hydrostatic and earth pressures that may result after ends of abandoned piping have been closed. Use either procedure below:
 - 1. Close open ends of piping with at least 8-inch- thick, brick masonry bulkheads.
 - 2. Close open ends of piping with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Do not use wood plugs.

- B. Abandoned Manholes and Structures: Excavate around manholes and structures as required and use one procedure below:
 - 1. Remove manhole or structure and close open ends of remaining piping.
 - 2. Remove top of manhole or structure down to at least 36 inches below final grade. Fill to within 12 inches of top with stone, rubble, or gravel. Fill to top with concrete in paved areas or earth in non-paved areas.
- C. Backfill to grade according to Division 31 Section "Earth Moving."

3.15 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over non-metallic ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.16 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 - 1. Submit separate reports for each system inspection.
 - 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 - 3. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 - 1. Do not enclose, cover, or put into service before inspection and approval.
 - 2. Test completed piping systems according to authorities having jurisdiction.
 - 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 - 4. Submit separate report for each test.

5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Option: Test HDPE according to ASTM F2487.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924.
- C. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.17 CLEANING

- A. Clean interior of piping of dirt and superfluous materials.

END OF SECTION

**APPENDIX A:
BID DOCUMENTS**



SUBSTITUTION REQUEST (During the Bidding Phase)

Project _____ Substitution Request Number: N/A

 From: _____
 To: _____ Date: _____

 A/E Project Number: _____
 Re: _____ Contract For: _____

Specification Title: _____ Description: _____
 Section: _____ Page: _____ Article/Paragraph: _____

Proposed Substitution: _____
 Manufacturer: _____ Address: _____ Phone: _____
 Trade Name: _____ Model No.: _____

Attached data includes product description, specifications, drawings, photographs, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified.

Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.

Submitted by: _____
 Signed by: _____ *Signature required*
 Firm: _____
 Address: _____
 Telephone: _____

A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01330.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by: _____ Date: _____

Supporting Data Attached: Drawings Product Data Samples Tests Reports _____



SUBSTITUTION REQUEST (After the Bidding Phase)

Project: Substitution Request Number: N/A
From:
To: Paragon Architecture Date:
A/E Project Number:
Re: Contract For:

Specification Title: Description:
Section: Page: Article/Paragraph:

Proposed Substitution:
Manufacturer: Address: Phone:
Trade Name: Model No.:
Installer: Address: Phone:
History: New product 2-5 years old 5-10 years old More than 10 years old
Differences between proposed substitution and specified product:

Point-by-point comparative data attached - REQUIRED BY Fill in if required

Reason for not providing specified item:

Similar Installation:
Project: Architect:
Address: Owner:
Date Installed:

Proposed substitution affects other parts of Work: No Yes; explain

Savings to Owner for accepting substitution: (\$)

Proposed substitution changes Contract Time: No Yes [Add] [Deduct] days.

Supporting Data Attached: Drawings Product Data Samples Tests Reports

SUBSTITUTION REQUEST (Continued)

The Undersigned certifies:

- Proposed substitution has been fully investigated and determined to be equal or superior in all respects to specified product.
- Same warranty will be furnished for proposed substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Proposed substitution will have no adverse effect on other trades and will not affect or delay progress schedule.
- Cost data as stated above is complete. Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Proposed substitution does not affect dimensions and functional clearances.
- Payment will be made for changes to building design, including A/E design, detailing, and construction costs caused by the substitution.
- Coordination, installation, and changes in the Work as necessary for accepted substitution will be complete in all respects.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

Telephone: _____

Attachments: _____

A/E's REVIEW AND ACTION

- Substitution approved - Make submittals in accordance with Specification Section 01330.
- Substitution approved as noted - Make submittals in accordance with Specification Section 01330.
- Substitution rejected - Use specified materials.
- Substitution Request received too late - Use specified materials.

Signed by:

Date:

Additional Comments: Contractor Subcontractor Supplier Manufacturer A/E _____

Missouri

Division of Labor Standards

WAGE AND HOUR SECTION



MICHAEL L. PARSON, Governor

Annual Wage Order No. 29

Section 005
BARRY COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by _____

Todd Smith, Director
Division of Labor Standards

Filed With Secretary of State: _____ **March 10, 2022**

Last Date Objections May Be Filed: **April 11, 2022**

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Asbestos Worker	\$24.04*
Boilermaker	\$24.04*
Bricklayer	\$24.04*
Carpenter	\$24.04*
Lather	
Linoleum Layer	
Millwright	
Pile Driver	
Cement Mason	\$24.04*
Plasterer	
Communications Technician	\$24.04*
Electrician (Inside Wireman)	\$46.47
Electrician Outside Lineman	\$24.04*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Elevator Constructor	\$24.04*
Glazier	\$24.04*
Ironworker	\$24.04*
Laborer	\$24.04*
General Laborer	
First Semi-Skilled	
Second Semi-Skilled	
Mason	\$24.04*
Marble Mason	
Marble Finisher	
Terrazzo Worker	
Terrazzo Finisher	
Tile Setter	
Tile Finisher	
Operating Engineer	\$24.04*
Group I	
Group II	
Group III	
Group III-A	
Group IV	
Group V	
Painter	\$24.04*
Plumber	\$24.04*
Pipe Fitter	
Roofer	\$24.04*
Sheet Metal Worker	\$55.08
Sprinkler Fitter	\$24.04*
Truck Driver	\$24.04*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in Section 290.210 RSMo.

Heavy Construction Rates for
BARRY County

Section 005

OCCUPATIONAL TITLE	**Prevailing Hourly Rate
Carpenter	\$24.04*
Millwright	
Pile Driver	
Electrician (Outside Lineman)	\$24.04*
Lineman Operator	
Lineman - Tree Trimmer	
Groundman	
Groundman - Tree Trimmer	
Laborer	\$41.41
General Laborer	
Skilled Laborer	
Operating Engineer	\$49.33
Group I	
Group II	
Group III	
Group IV	
Truck Driver	\$24.04*
Truck Control Service Driver	
Group I	
Group II	
Group III	
Group IV	

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate Sheet.

*The Division of Labor Standards received fewer than 1,000 reportable hours for this occupational title. The public works contracting minimum wage is established for this occupational title using data provided by Missouri Economic Research and Information Center.

**The Prevailing Hourly Rate includes any applicable fringe benefit amounts for each occupational title as defined in Section 290.210 RSMo.

OVERTIME and HOLIDAYS

OVERTIME

For all work performed on a Sunday or a holiday, not less than twice (2x) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work.

For all overtime work performed, not less than one and one-half (1½) the prevailing hourly rate of wages for work of a similar character in the locality in which the work is performed or the public works contracting minimum wage, whichever is applicable, shall be paid to all workers employed by or on behalf of any public body engaged in the construction of public works, exclusive of maintenance work or contractual obligation. For purposes of this subdivision, "**overtime work**" shall include work that exceeds ten hours in one day and work in excess of forty hours in one calendar week; and

A thirty-minute lunch period on each calendar day shall be allowed for each worker on a public works project, provided that such time shall not be considered as time worked.

HOLIDAYS

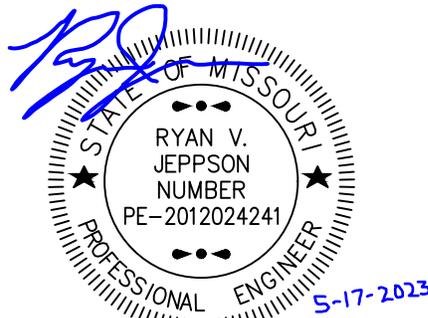
January first;
The last Monday in May;
July fourth;
The first Monday in September;
November eleventh;
The fourth Thursday in November; and
December twenty-fifth;

If any holiday falls on a Sunday, the following Monday shall be considered a holiday.

**FINAL DRAINAGE REPORT
FOR
CASSVILLE HIGH SCHOOL
PERFORMING ARTS CENTER

CASSEVILLE, MISSOURI**

Prepared for:
Cassville R-IV School District
1501 Main Street.
Cassville, MO 65625



RYAN V. JEPSON
PROFESSIONAL ENGINEER
MO# PE-2012024241

May 2023

Prepared By:
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Missouri Engineering Certificate of Authority #001592
021-06600



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APPENDICES

APPENDIX A: Hydrology and Detention Routing Calculations

APPENDIX B: Storm Sewer Calculations

I. **PROJECT DESCRIPTION AND BACKGROUND**

This report presents stormwater management design calculations for the proposed Cassville High School Performing Arts Center expansion. The project is located at the northeast corner of State Highway Y and Partridge Drive in Cassville, Missouri. The project site is already occupied by the existing Cassville High School. On the south portion of the high school, storm water is collected into a 15" storm drain that is routed and discharged south of the existing high school. This stormwater generally flows east towards the existing soccer field and then flows northeast to the existing pond and Flat Creek floodplain. A summary of the existing drainage conditions and drainage area configuration is provided in Figure F-1 of this report.

The proposed building and parking expansion for the new performing arts center will increase the amount of stormwater runoff generated onsite. To mitigate this increase in runoff, a new dry detention basin will be provided. The detention will detain the increased volume of stormwater generated by the new improvements. The detention outlet structure will allow the detention basin to drain in a controlled method that will maintain existing peak flow rates downstream. A summary of the post development drainage condition is provided in Figure F-2 of this report.

II. **DETENTION SUMMARY**

Storm water detention calculations were performed in accordance using *Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2022*. Rainfall depth & duration data was taken from NOAA Atlas 14. A summary of the watershed data used in the calculations are presented in Table 1A, 1B, and 1C. Precipitation was distributed using the Huff Distribution, precipitation losses were determined using the Runoff Curve Number (CN) Method, the storm runoff hydrograph was determined using the NRCS Unit Hydrograph Method. Hydrographs routed through detention used the Modified Plus Method. The 30-minute storm duration was used in the hydrologic calculations. A summary of the detention routing calculations for the dry detention basin is provided in Table 2. The complete hydrology analysis can be found in Appendix A.

TABLE 1A– EXISTING EX 10 WATERSHED DATA

	Drainage Area (acres)	Cover Type	Soil Group	Curve Number	Tc (Minutes)
EX 10	2.04	Pavement	-	98	5.00
	4.47	Open Space	C	74	
TOTAL AREA	6.51 ACRES				
COMPOSITE CN=	82				

TABLE 1B– EXISTING EX 20 WATERSHED DATA

	Drainage Area (acres)	Cover Type	Soil Group	Curve Number	Tc (Minutes)
EX 20	0.92	Pavement	-	98	5.00
	1.07	Open Space	C	74	
TOTAL AREA	1.99 ACRES				
COMPOSITE CN=	85				

TABLE 1C– POST DEVELOPMENT DEV 10 WATERSHED DATA

	Drainage Area (acres)	Cover Type	Soil Group	Curve Number	Tc (Minutes)
DEV 10	4.18	Pavement	-	98	5.00
	2.33	Open Space	C	74	
TOTAL AREA	6.51				
COMPOSITE CN=	89				

TABLE 2 – DETENTION BASIN SUMMARY

Return Frequency	Predevelopment Flow Rates (cfs)	Post-Development Discharge (cfs)	Storage Volume (cf)	Maximum WSE (ft)
2	4.96	2.16	6,930	1302.01
10	12.08	7.74	10,693	1302.65
100	27.76	20.41	16,224	1303.46

III. **STORM SEWER SYSTEM**

The Hydraflow Storm Sewers Extension, that is part of the 2020 version of Autodesk Civil 3D software, was used to model storm sewer capacity for the 5, 25, and 100-year storm frequencies. The Hydraflow Storm Sewer Extension uses the energy-based Standard Step method to compute the hydraulic profile. This method is an iterative procedure that applies Bernoulli's Energy Equation between the downstream and upstream ends of each line in the system. It uses Manning's Equation to determine head losses due to pipe friction. Using this method, a solution can always be found regardless of the flow regime. This method makes no assumptions as to the depth of the flow and is

only accepted when the energy equation is balanced. Public Storm sewer calculation reports, and HGL/EGL profiles are in Appendix B. Figures F-3 provide diagrams of the storm sewer inlet drainage areas. Flow rates in the storm system were established using the Rational Method and are in the table on Figure F-3

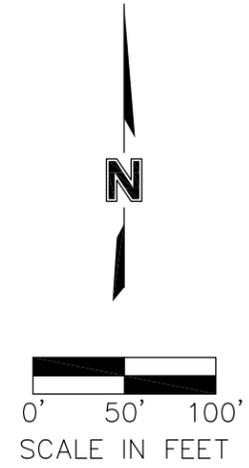
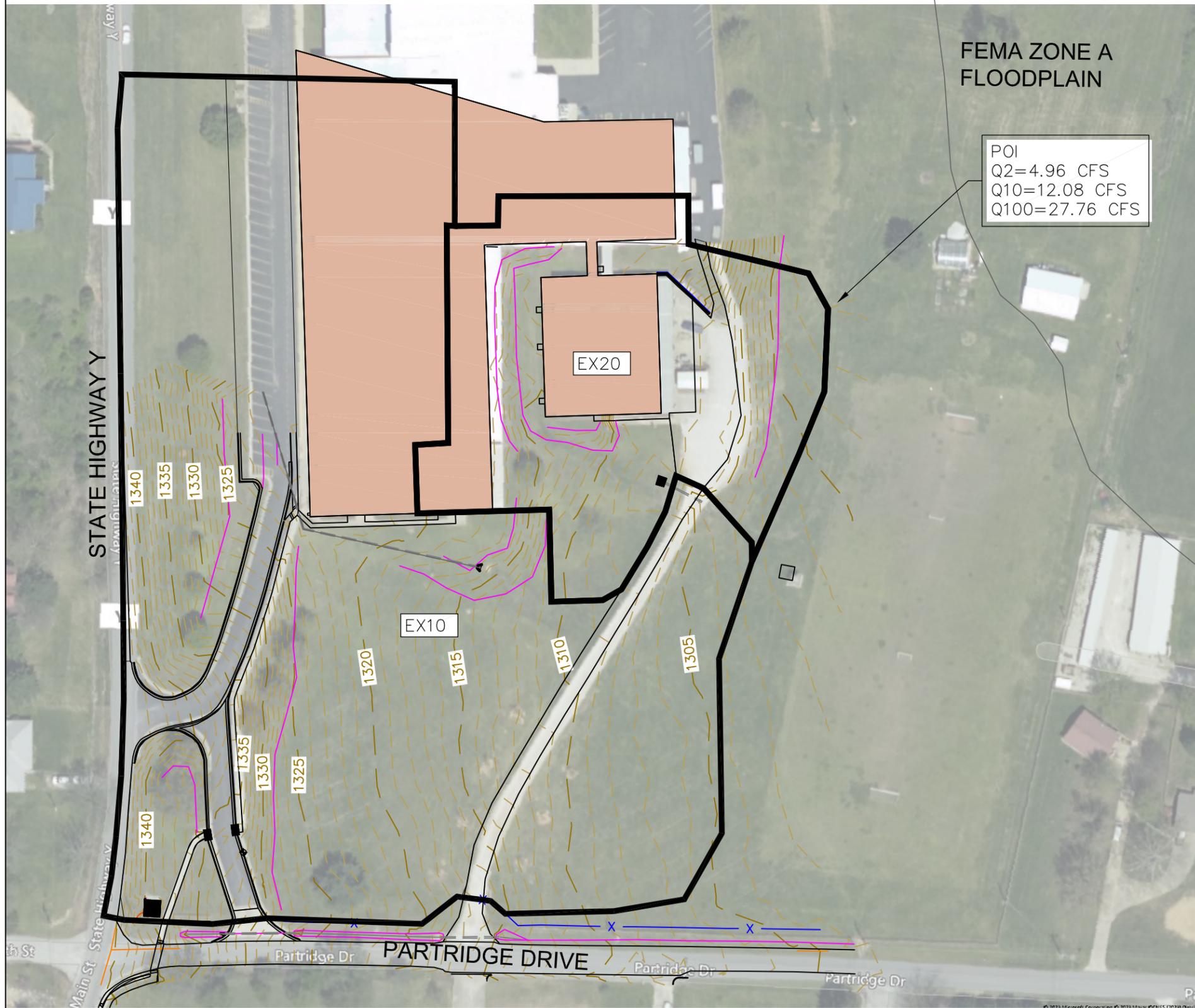
REFERENCES

USDA Web Soil Survey, <https://websoilsurvey.nrcs.usda.gov/app/HomePage.htm>

NOAA Atlas 14, [PF Map: Contiguous US \(noaa.gov\)](https://www.noaa.gov/maps/pf-maps/)

Autodesk Civil 3D Hydraflow Storm Sewers Extension User Guide, 2020.

DWG: F:\2021\06501-07000\021-06600\40-Design\AutoCAD\Final_Plans\Xref\C_XHYDR_02106600.dwg
 DATE: Mar 29, 2023 5:29am XREFS: JOP-100-5925 FOR CLIENT C_PBASET_02106600 USER: rjppson



LEGEND

WATERSHED BOUNDARY

SUMMARY TABLE			
SUBBASIN	AREA (AC)	CN	TC (MIN.)
EX10	6.51	82	5.0
EX 20	0.92	85	5.00

PROJECT:
 DRAWN BY: RVJ
 DATE: 03/29/2023

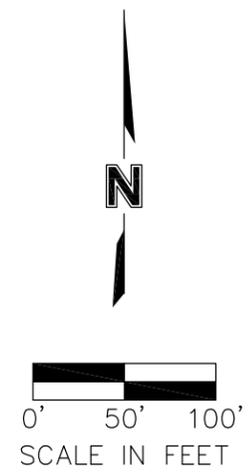
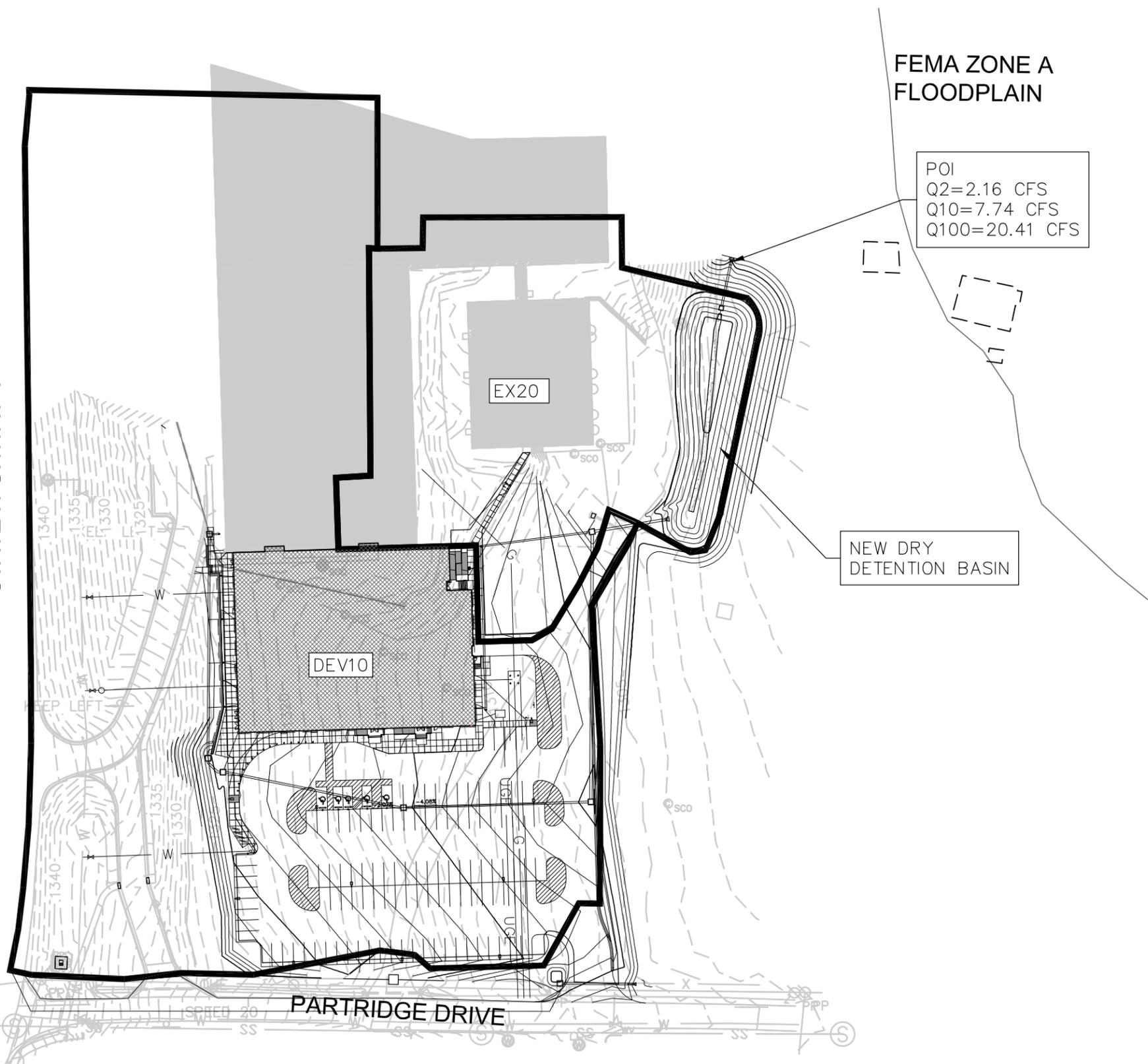
EXISTING CONDITIONS DRAINAGE EXHIBIT

olsson
 550 St. Louis Street
 Springfield, MO 65806
 TEL 417.890.8802

FIGURE
F-1

DWG: F:\2021\06501-07000\021-06600\40-Design\AutoCAD\Final Plans\C_PHYDR_02106600.dwg
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STATE HIGHWAY Y



LEGEND

————— WATERSHED BOUNDARY

SUMMARY TABLE			
SUBBASIN	AREA (AC)	CN	TC (MIN.)
DEV10	6.51	89	5.00
EX 20	0.92	85	5.00

PROJECT:
 DRAWN BY: RVJ
 DATE: 04/26/2023

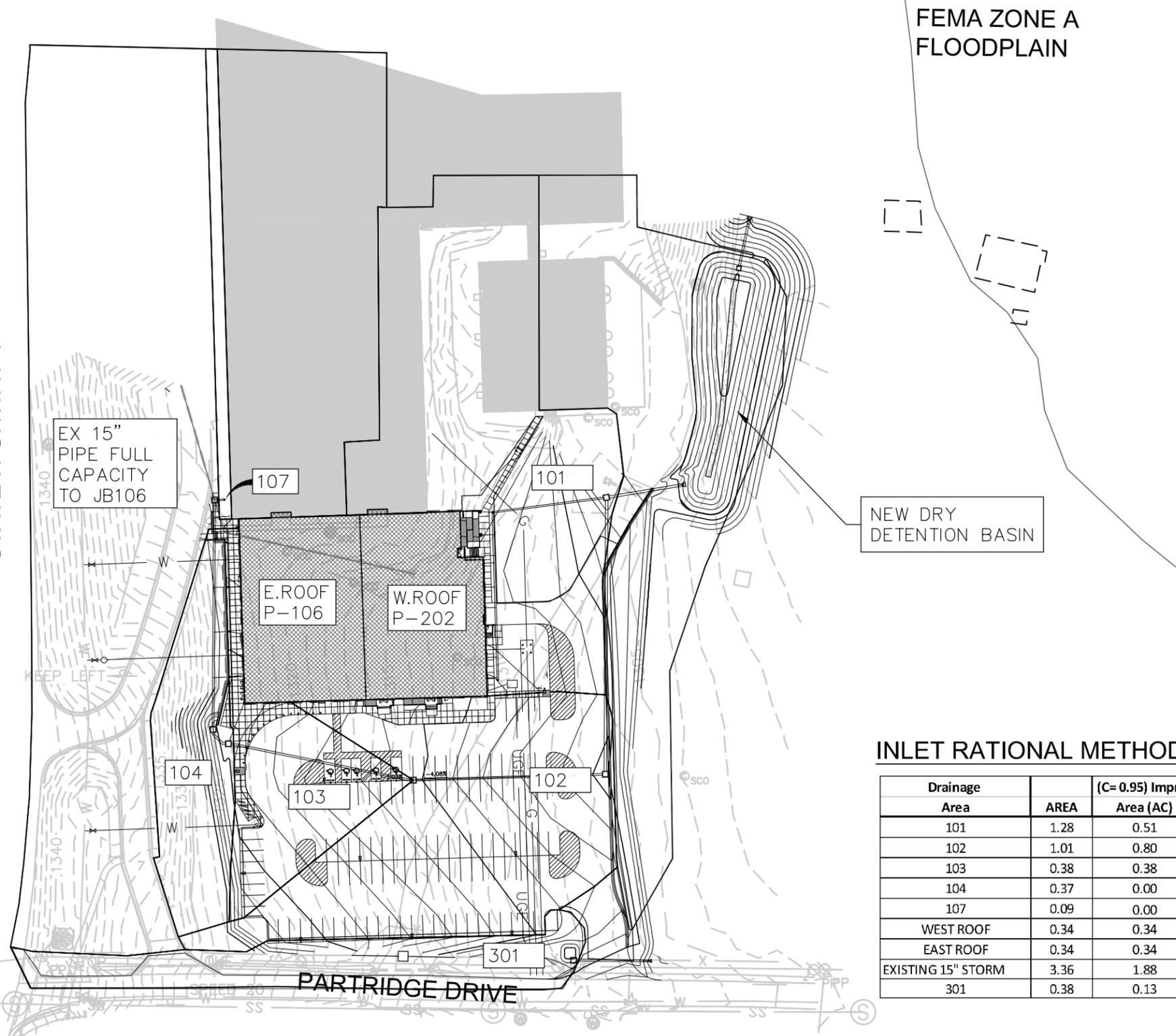
POST DEVELOPMENT CONDITIONS EXHIBIT

olsson
 550 St. Louis Street
 Springfield, MO 65806
 TEL 417.890.8802

FIGURE
 F-2

DWG: F:\2021\06501-07000\021-06600\40-Design\AutoCAD\Final Plans\C_PHYDR_02106600.dwg
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 USER: rjeppson

STATE HIGHWAY Y



FEMA ZONE A FLOODPLAIN

NEW DRY DETENTION BASIN



LEGEND

———— INLET DRAINAGE AREA BOUNDARY

INLET RATIONAL METHOD CALCULATION

Drainage Area	AREA	(C=0.95) Imprv. Area (AC)	(C=0.20) Lawn Space (AC)	C	Tc (min)	i5 (in/hr)	i25 (in/hr)	i100 (in/hr)	Q2(cfs)	Q25(cfs)	Q100(cfs)
101	1.28	0.51	0.77	0.50	5	6.4	8.63	10.7	4.11	5.54	6.87
102	1.01	0.80	0.21	0.80	5	6.4	8.63	10.7	5.14	6.93	8.60
103	0.38	0.38	0.00	0.95	5	6.4	8.63	10.7	2.31	3.12	3.86
104	0.37	0.00	0.37	0.20	5	6.4	8.63	10.7	0.47	0.64	0.79
107	0.09	0.00	0.09	0.20	5	6.4	8.63	10.7	0.12	0.16	0.19
WEST ROOF	0.34	0.34	0.00	0.95	5	6.4	8.63	10.7	2.07	2.79	3.46
EAST ROOF	0.34	0.34	0.00	0.95	5	6.4	8.63	10.7	2.07	2.79	3.46
EXISTING 15" STORM	3.36	1.88	1.48	0.62	5	6.4	8.63	10.7	13.31	17.95	22.25
301	0.38	0.13	0.25	0.46	5	6.4	8.63	10.7	1.11	1.50	1.86

PROJECT:
 DRAWN BY: RVJ
 DATE: 04/26/2023

INLET DRAINAGE AREA MAP

olsson
 550 St. Louis Street
 Springfield, MO 65806
 TEL 417.890.8802

FIGURE
 F-3

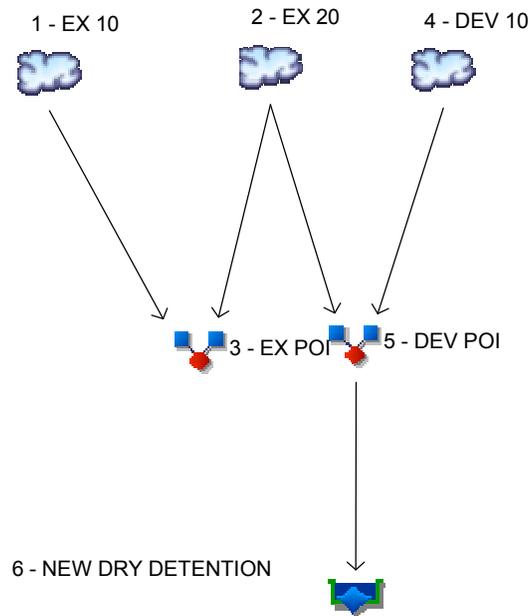
APPENDIX A

Hydrology and Detention Routing Calculations

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Watershed Model Schematic

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022



Legend

Hyd. Origin	Description
1 SCS Runoff	EX 10
2 SCS Runoff	EX 20
3 Combine	EX POI
4 SCS Runoff	DEV 10
5 Combine	DEV POI
6 Reservoir	NEW DRY DETENTION

Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	3.470	2	14	3,851	-----	-----	-----	EX 10	
2	SCS Runoff	1.571	2	12	1,641	-----	-----	-----	EX 20	
3	Combine	4.959	2	14	5,491	1, 2	-----	-----	EX POI	
4	SCS Runoff	8.311	2	10	8,443	-----	-----	-----	DEV 10	
5	Combine	9.698	2	10	10,084	2, 4	-----	-----	DEV POI	
6	Reservoir	2.162	2	32	10,080	5	1302.01	6,930	NEW DRY DETENTION	
Cassville High School Expansion 0.5-Hour Analysis					Return Period: 2 Year			Wednesday, 03 / 29 / 2023		

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

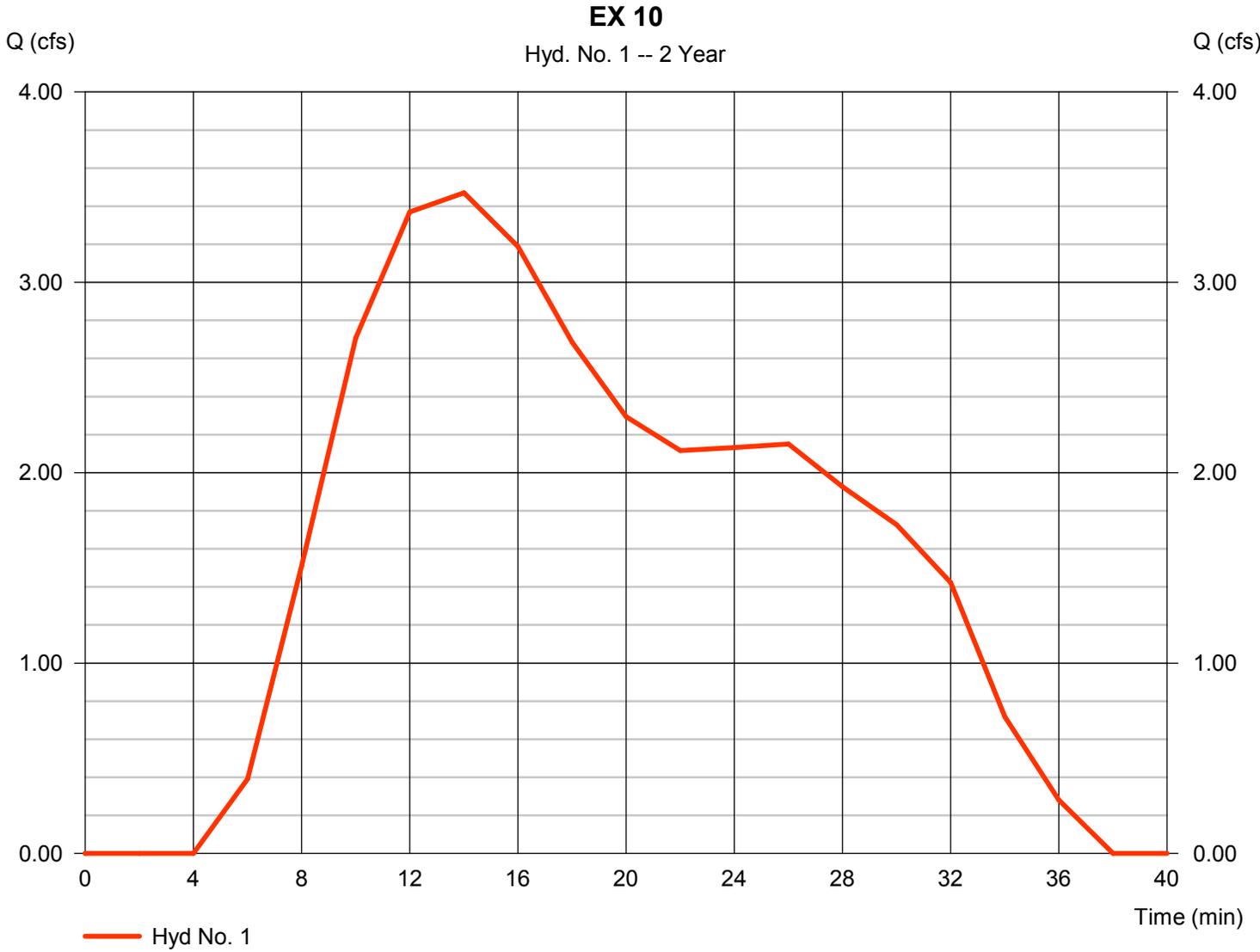
Wednesday, 03 / 29 / 2023

Hyd. No. 1

EX 10

Hydrograph type	= SCS Runoff	Peak discharge	= 3.470 cfs
Storm frequency	= 2 yrs	Time to peak	= 14 min
Time interval	= 2 min	Hyd. volume	= 3,851 cuft
Drainage area	= 6.510 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.15 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.040 x 98) + (4.470 x 74)] / 6.510



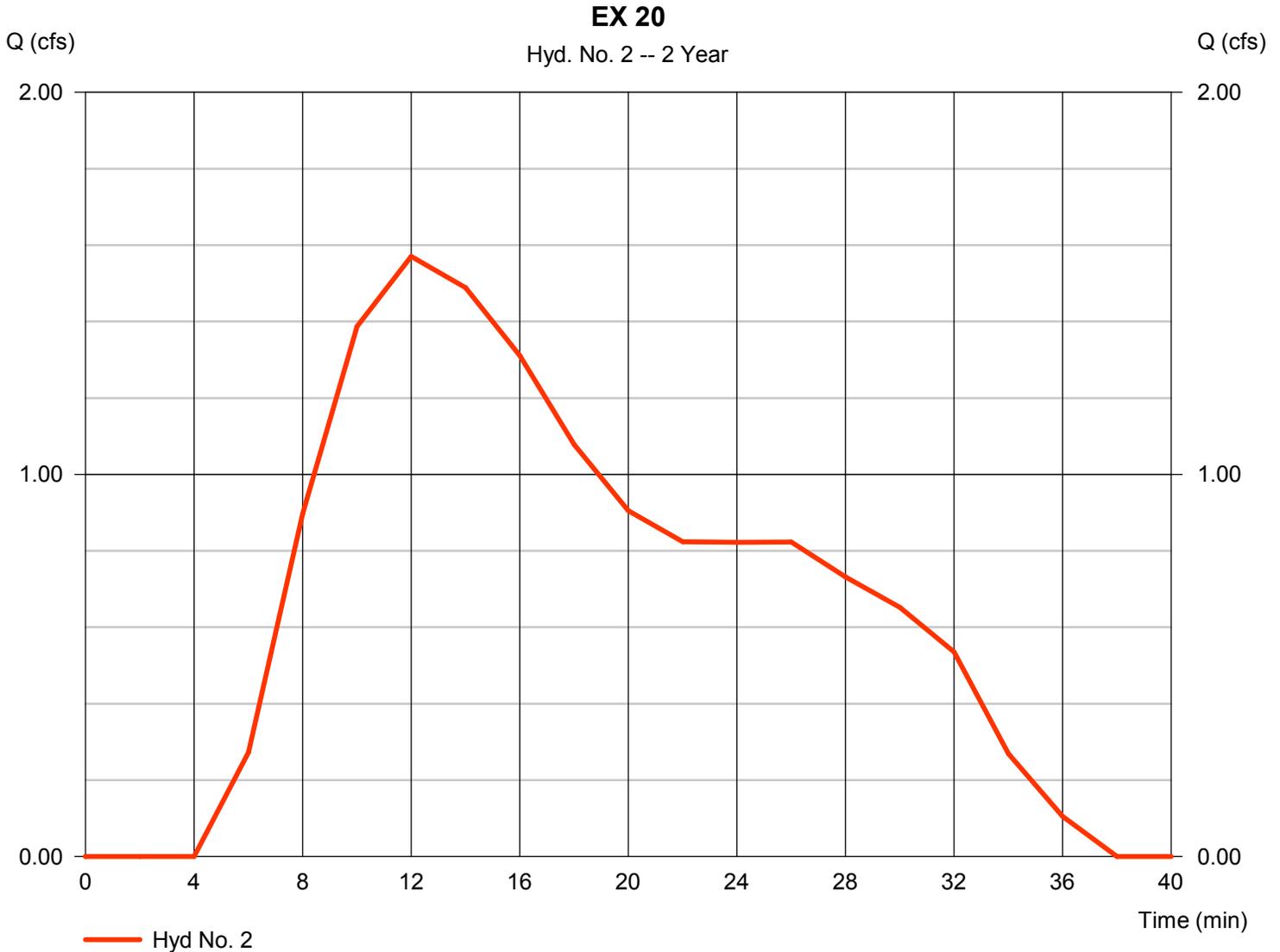
Hydrograph Report

Hyd. No. 2

EX 20

Hydrograph type	= SCS Runoff	Peak discharge	= 1.571 cfs
Storm frequency	= 2 yrs	Time to peak	= 12 min
Time interval	= 2 min	Hyd. volume	= 1,641 cuft
Drainage area	= 1.990 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.15 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.920 x 98) + (1.070 x 74)] / 1.990



Hydrograph Report

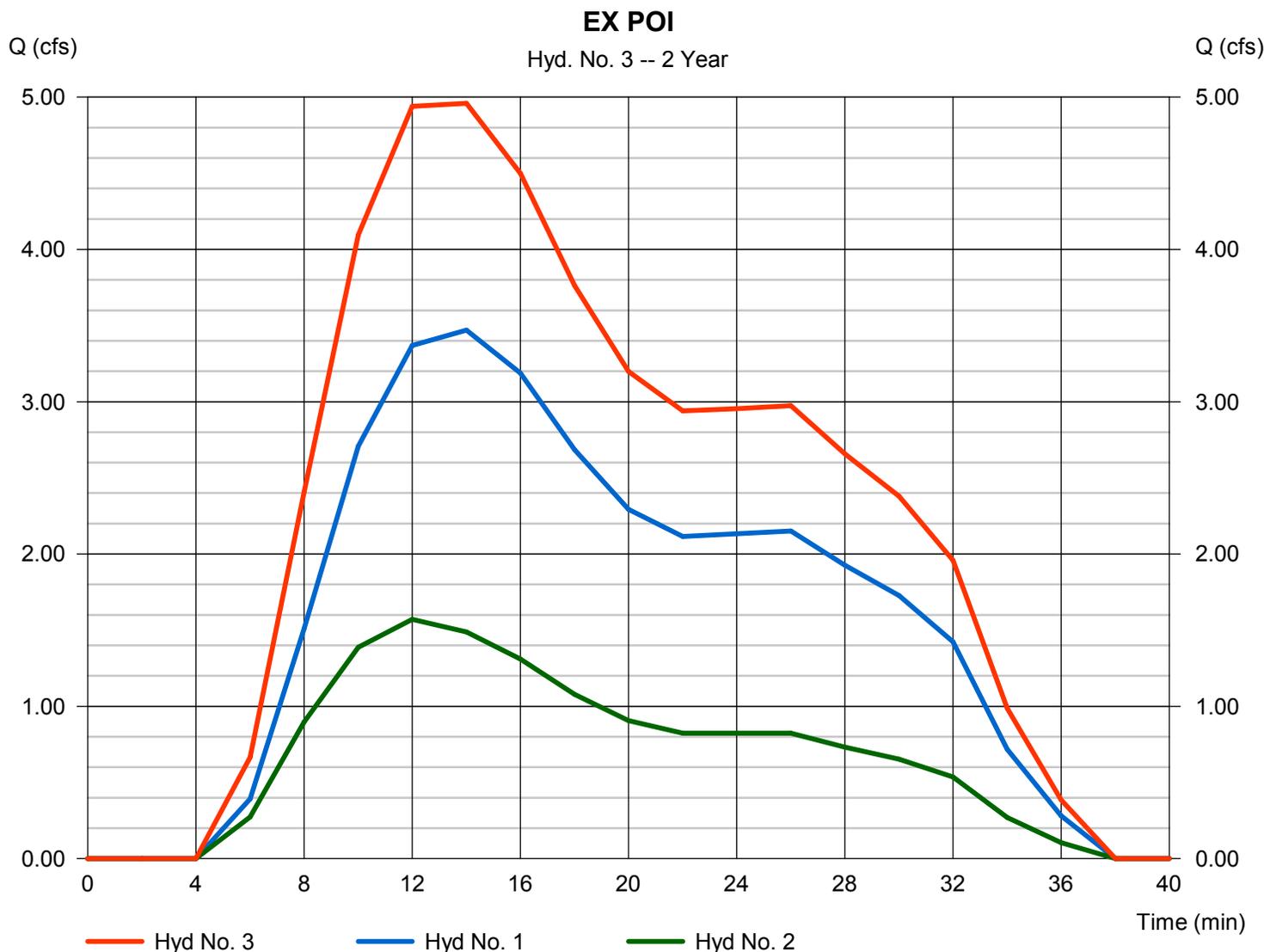
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Wednesday, 03 / 29 / 2023

Hyd. No. 3

EX POI

Hydrograph type	= Combine	Peak discharge	= 4.959 cfs
Storm frequency	= 2 yrs	Time to peak	= 14 min
Time interval	= 2 min	Hyd. volume	= 5,491 cuft
Inflow hyds.	= 1, 2	Contrib. drain. area	= 8.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

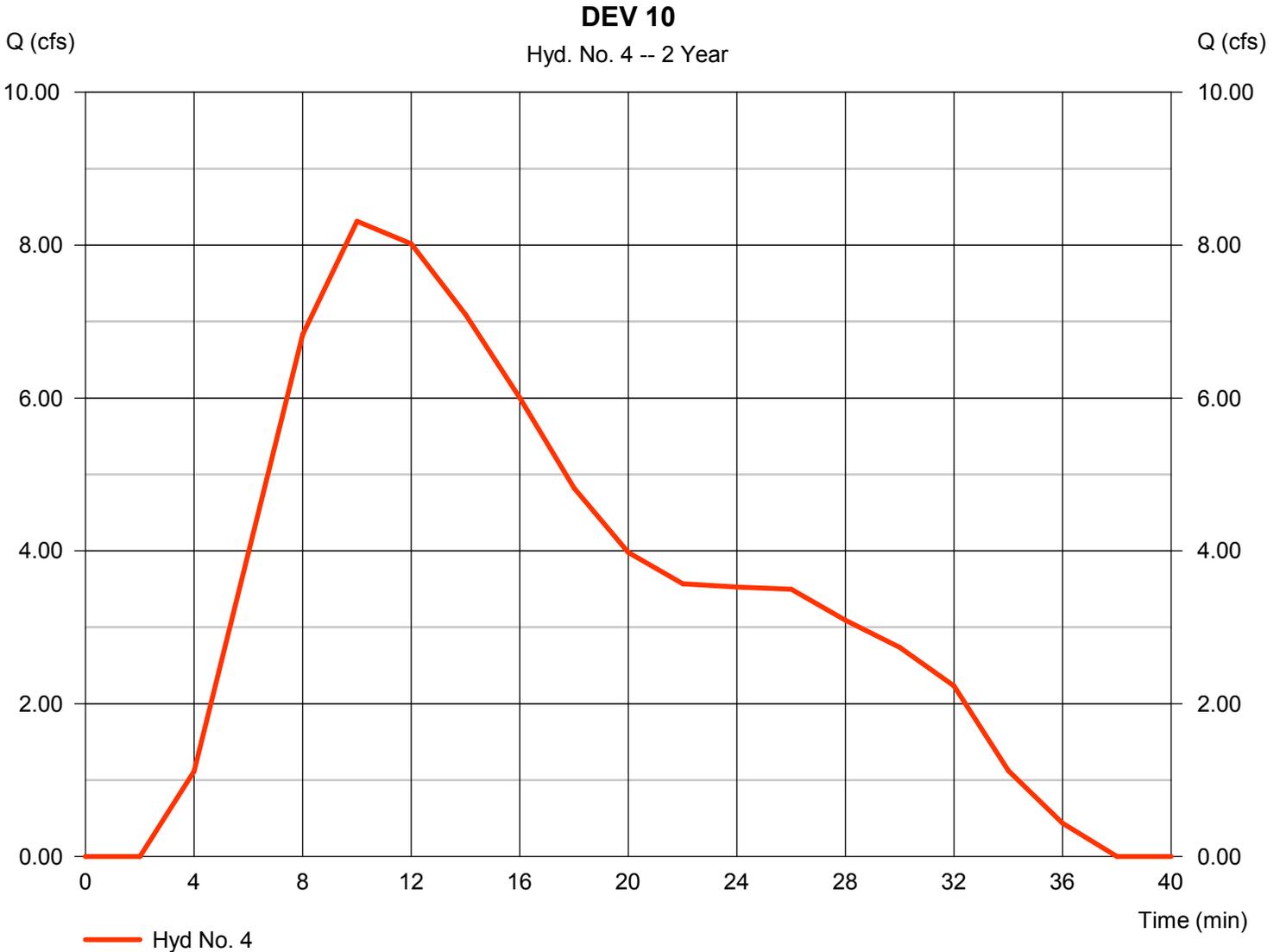
Wednesday, 03 / 29 / 2023

Hyd. No. 4

DEV 10

Hydrograph type	= SCS Runoff	Peak discharge	= 8.311 cfs
Storm frequency	= 2 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 8,443 cuft
Drainage area	= 6.510 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.15 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.180 x 98) + (2.330 x 74)] / 6.510



Hydrograph Report

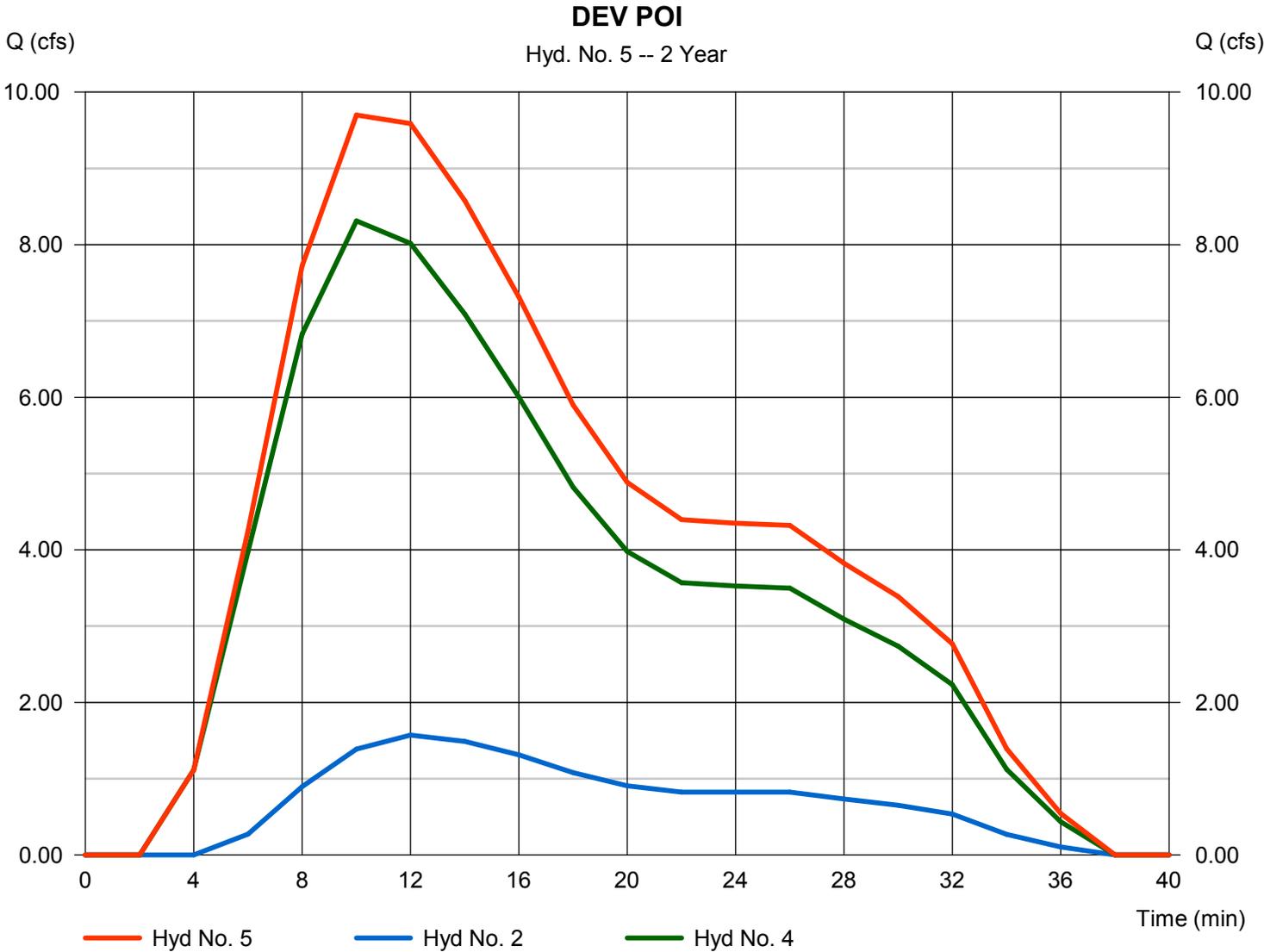
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Wednesday, 03 / 29 / 2023

Hyd. No. 5

DEV POI

Hydrograph type	= Combine	Peak discharge	= 9.698 cfs
Storm frequency	= 2 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 10,084 cuft
Inflow hyds.	= 2, 4	Contrib. drain. area	= 8.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Wednesday, 03 / 29 / 2023

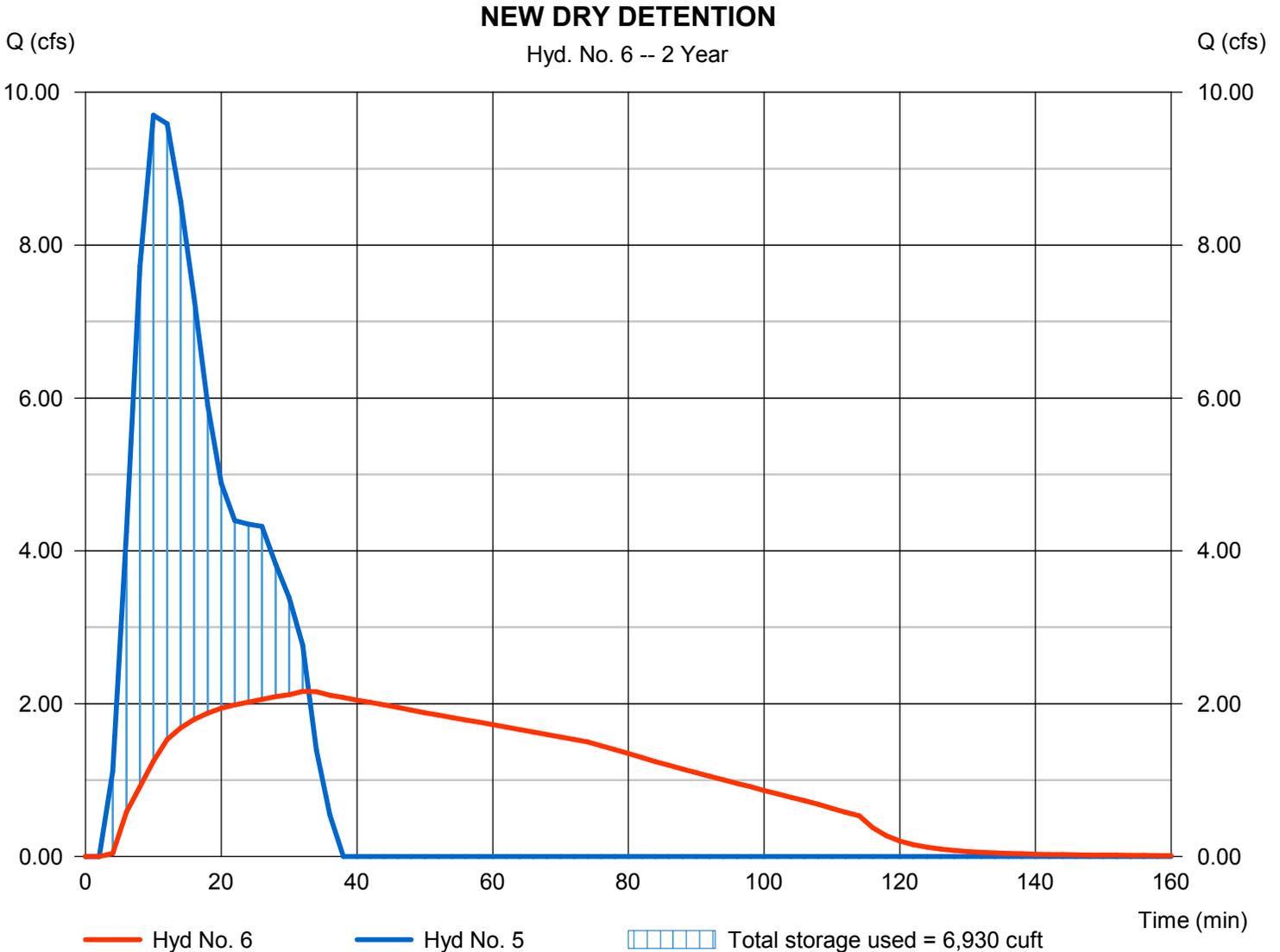
Hyd. No. 6

NEW DRY DETENTION

Hydrograph type = Reservoir
Storm frequency = 2 yrs
Time interval = 2 min
Inflow hyd. No. = 5 - DEV POI
Reservoir name = <New Pond>

Peak discharge = 2.162 cfs
Time to peak = 32 min
Hyd. volume = 10,080 cuft
Max. Elevation = 1302.01 ft
Max. Storage = 6,930 cuft

Storage Indication method used.



Pond No. 1 - <New Pond>

Pond Data

Contours -User-defined contour areas. Conic method used for volume calculation. Begining Elevation = 1299.50 ft

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	1299.50	00	0	0
0.50	1300.00	1,629	271	271
1.50	1301.00	3,362	2,444	2,715
2.50	1302.00	5,003	4,155	6,870
3.50	1303.00	6,743	5,851	12,721
4.50	1304.00	8,577	7,641	20,362

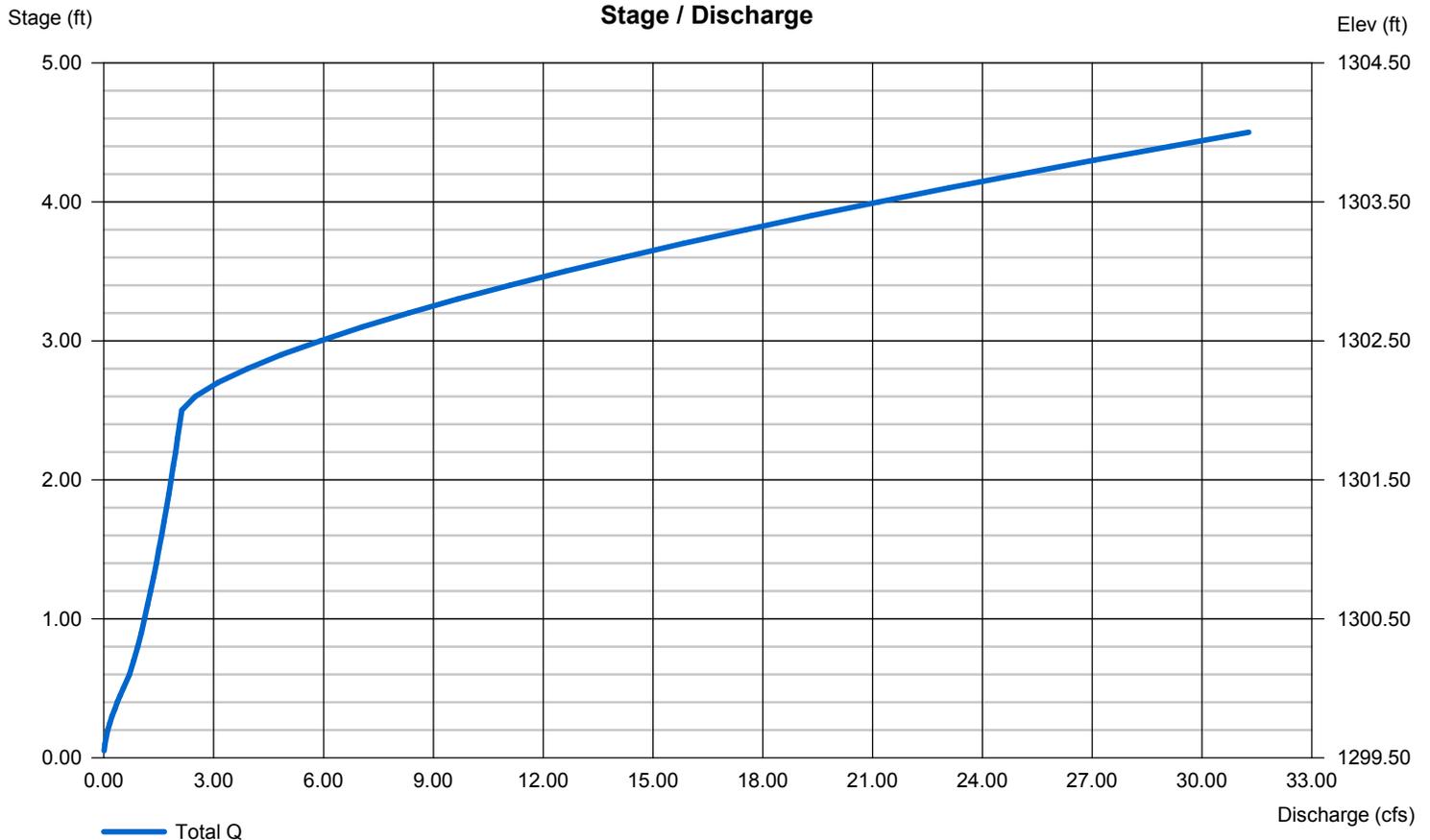
Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 18.00	8.00	0.00	0.00
Span (in)	= 18.00	8.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 1299.50	1299.50	0.00	0.00
Length (ft)	= 20.00	10.00	0.00	0.00
Slope (%)	= 0.50	1.00	0.00	n/a
N-Value	= .013	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 3.00	0.00	0.00	0.00
Crest El. (ft)	= 1302.00	0.00	0.00	0.00
Weir Coeff.	= 3.33	3.33	3.33	3.33
Weir Type	= Rect	---	---	---
Multi-Stage	= No	No	No	No
Exfil.(in/hr)	= 0.000 (by Contour)			
TW Elev. (ft)	= 0.00			

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	8.669	2	12	9,152	-----	-----	-----	EX 10
2	SCS Runoff	3.517	2	10	3,586	-----	-----	-----	EX 20
3	Combine	12.08	2	12	12,738	1, 2	-----	-----	EX POI
4	SCS Runoff	16.72	2	10	16,005	-----	-----	-----	DEV 10
5	Combine	20.24	2	10	19,591	2, 4	-----	-----	DEV POI
6	Reservoir	7.738	2	22	19,587	5	1302.65	10,693	NEW DRY DETENTION

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

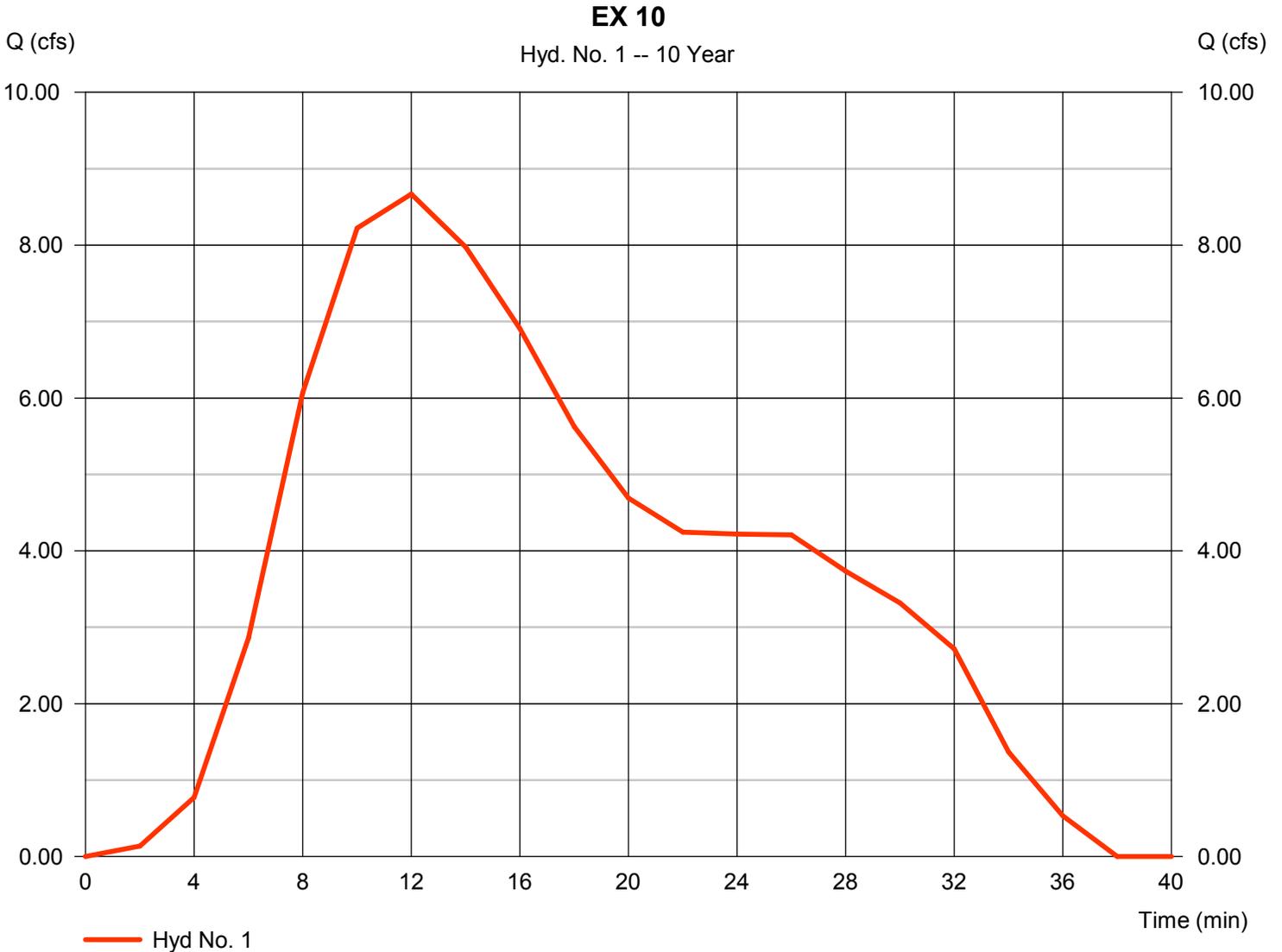
Wednesday, 03 / 29 / 2023

Hyd. No. 1

EX 10

Hydrograph type	= SCS Runoff	Peak discharge	= 8.669 cfs
Storm frequency	= 10 yrs	Time to peak	= 12 min
Time interval	= 2 min	Hyd. volume	= 9,152 cuft
Drainage area	= 6.510 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.62 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.040 x 98) + (4.470 x 74)] / 6.510



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

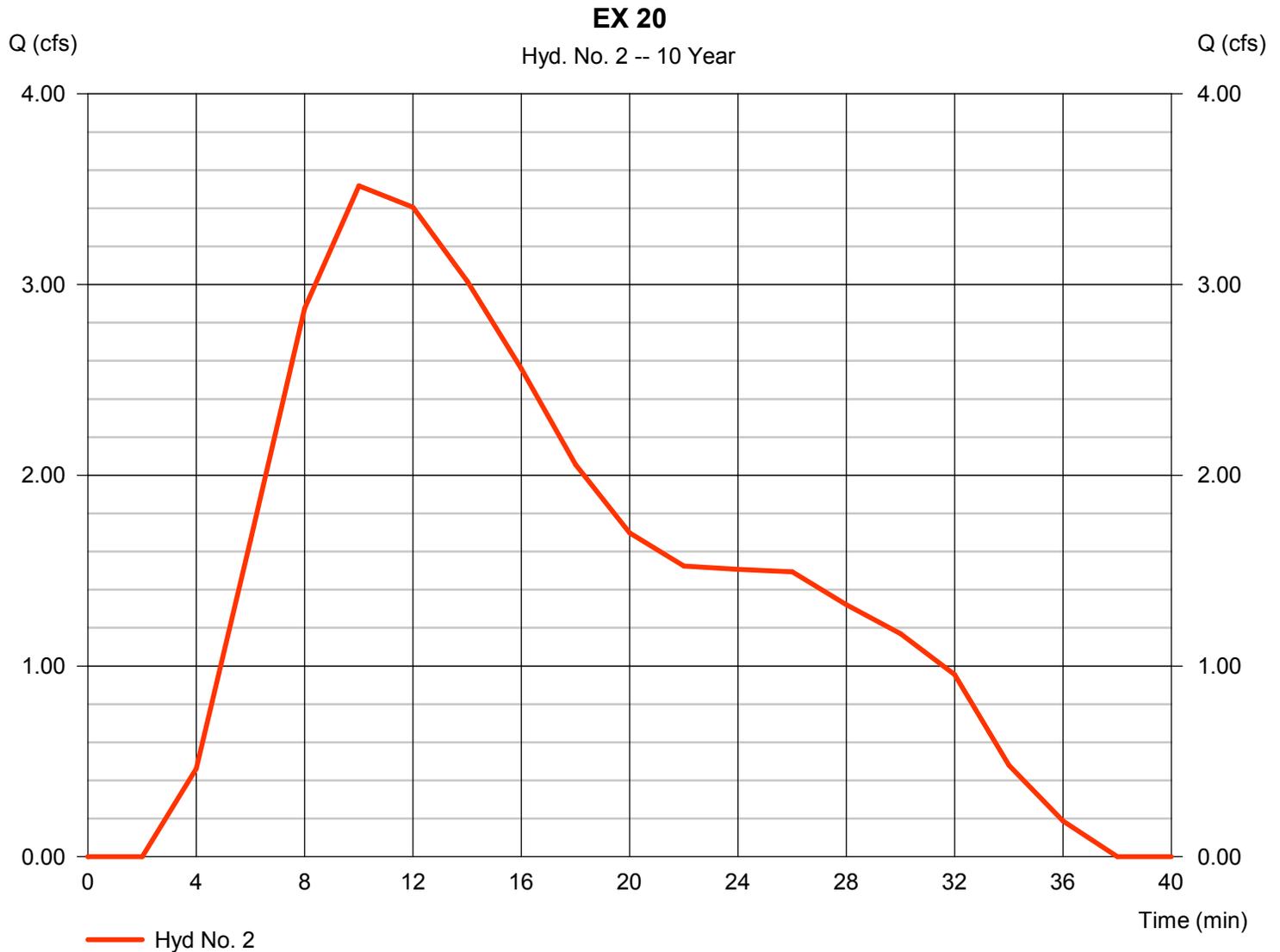
Wednesday, 03 / 29 / 2023

Hyd. No. 2

EX 20

Hydrograph type	= SCS Runoff	Peak discharge	= 3.517 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 3,586 cuft
Drainage area	= 1.990 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.62 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.920 x 98) + (1.070 x 74)] / 1.990



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

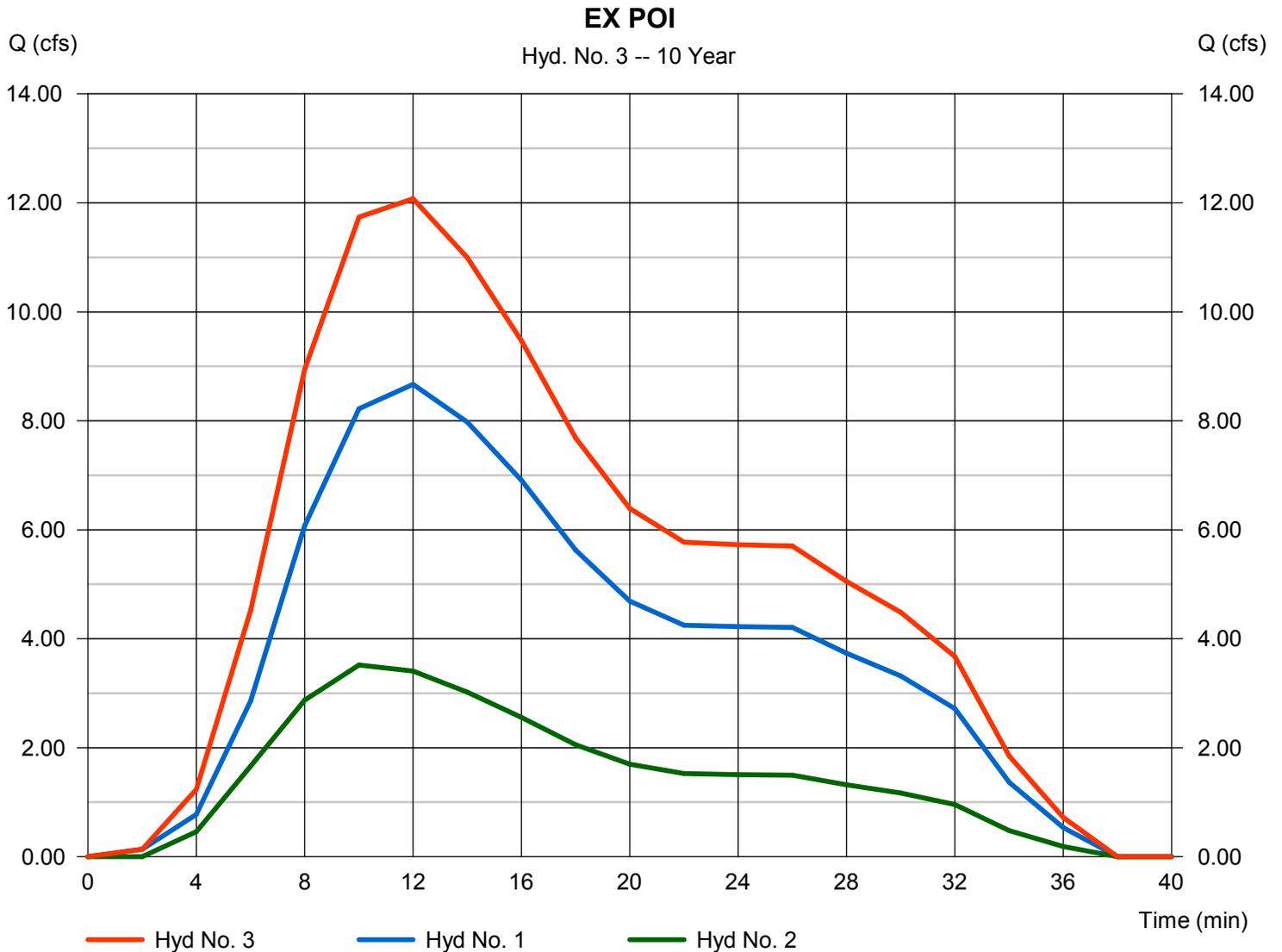
Wednesday, 03 / 29 / 2023

Hyd. No. 3

EX POI

Hydrograph type = Combine
Storm frequency = 10 yrs
Time interval = 2 min
Inflow hyds. = 1, 2

Peak discharge = 12.08 cfs
Time to peak = 12 min
Hyd. volume = 12,738 cuft
Contrib. drain. area = 8.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

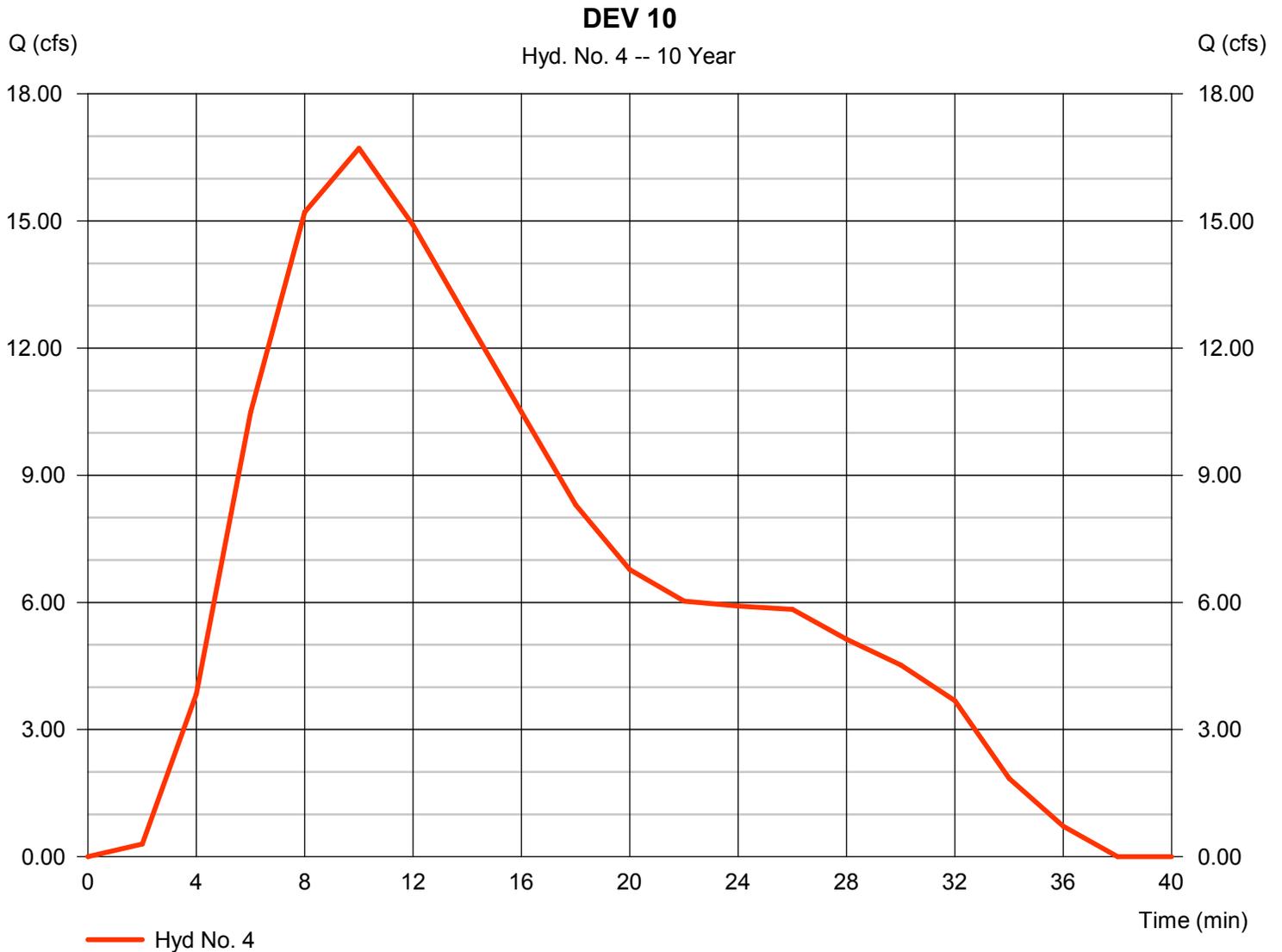
Wednesday, 03 / 29 / 2023

Hyd. No. 4

DEV 10

Hydrograph type	= SCS Runoff	Peak discharge	= 16.72 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 16,005 cuft
Drainage area	= 6.510 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 1.62 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.180 x 98) + (2.330 x 74)] / 6.510



Hydrograph Report

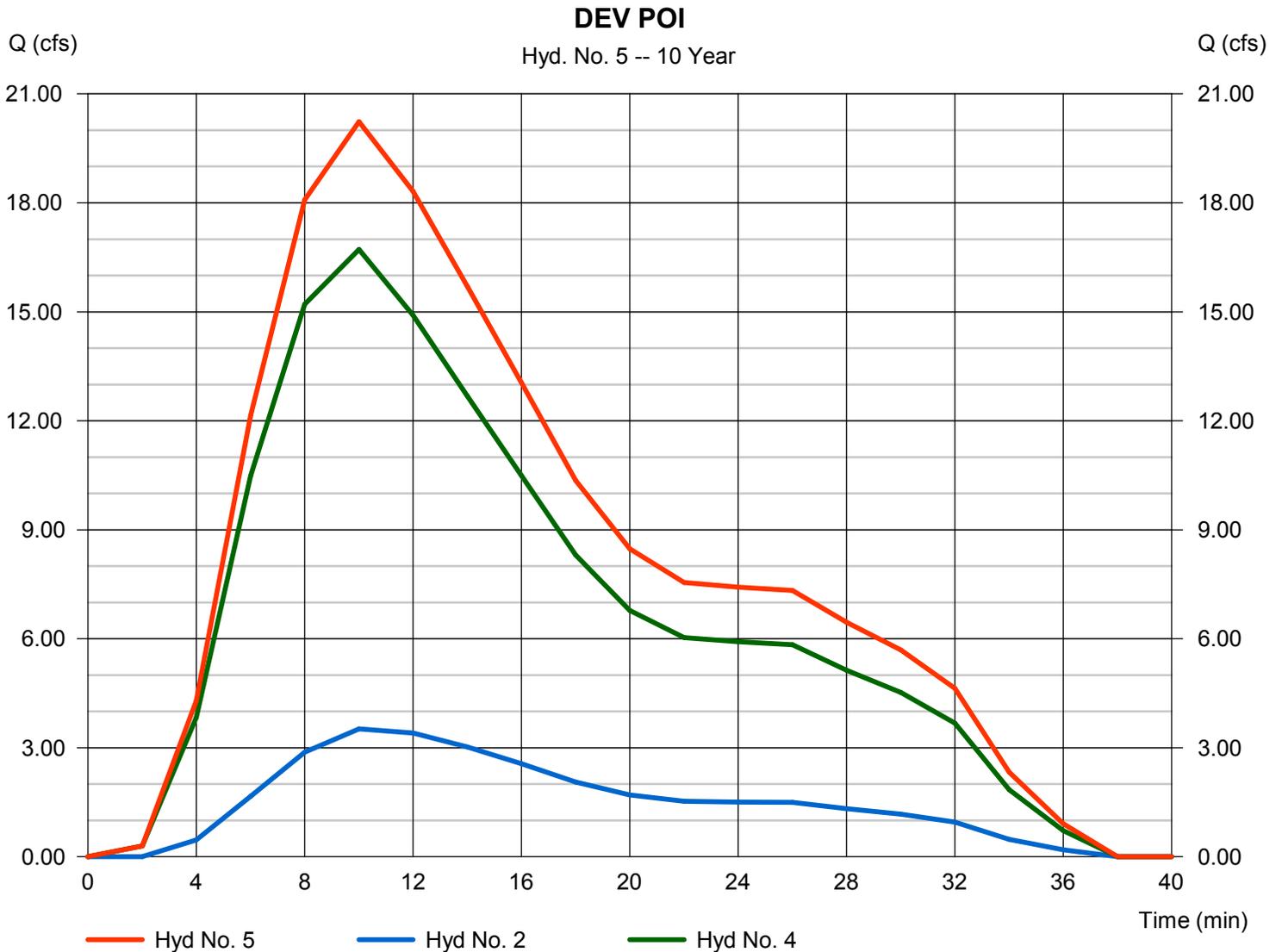
Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Wednesday, 03 / 29 / 2023

Hyd. No. 5

DEV POI

Hydrograph type	= Combine	Peak discharge	= 20.24 cfs
Storm frequency	= 10 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 19,591 cuft
Inflow hyds.	= 2, 4	Contrib. drain. area	= 8.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

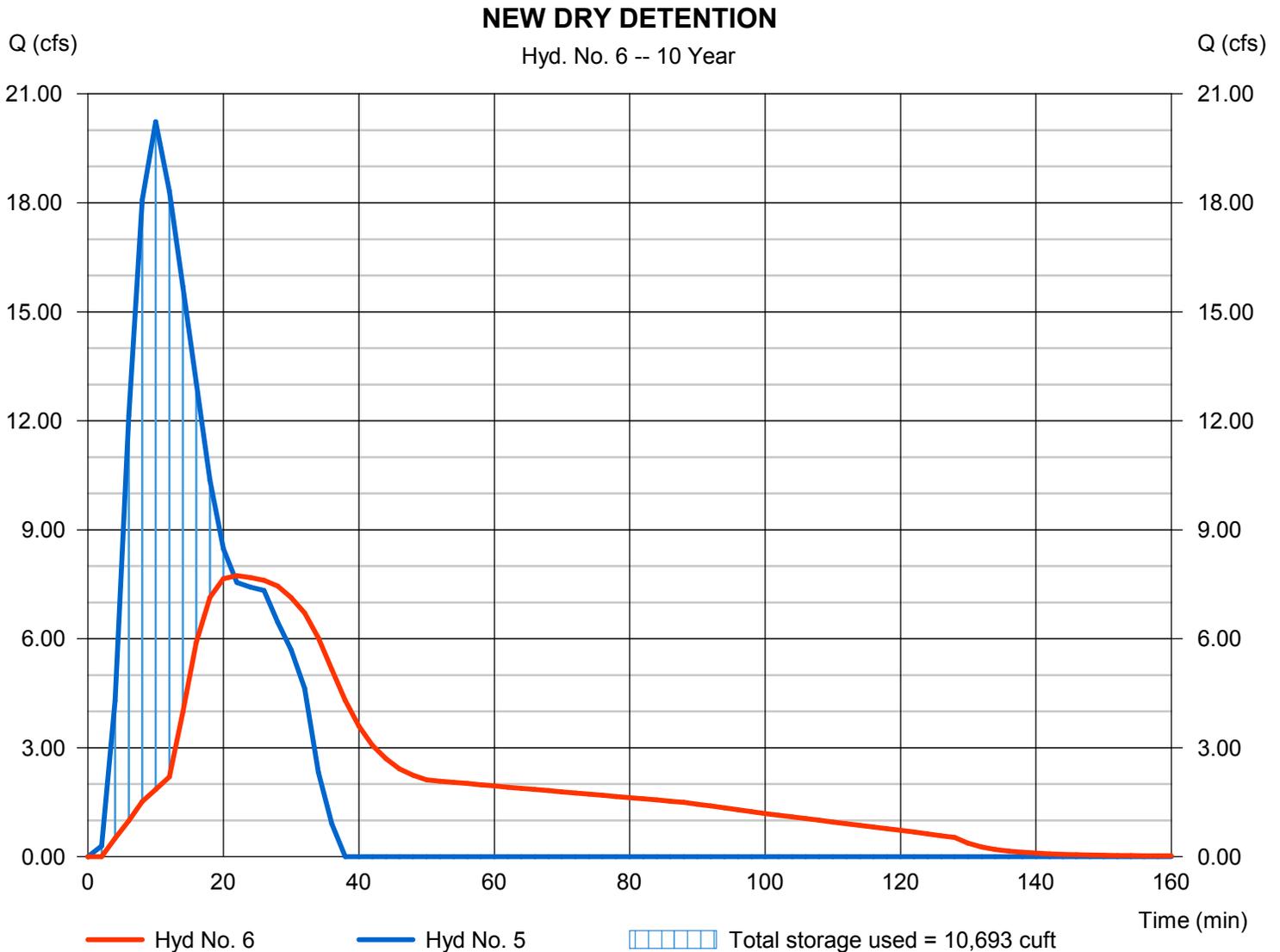
Wednesday, 03 / 29 / 2023

Hyd. No. 6

NEW DRY DETENTION

Hydrograph type	= Reservoir	Peak discharge	= 7.738 cfs
Storm frequency	= 10 yrs	Time to peak	= 22 min
Time interval	= 2 min	Hyd. volume	= 19,587 cuft
Inflow hyd. No.	= 5 - DEV POI	Max. Elevation	= 1302.65 ft
Reservoir name	= <New Pond>	Max. Storage	= 10,693 cuft

Storage Indication method used.



Hydrograph Summary Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description	
1	SCS Runoff	20.19	2	10	19,862	-----	-----	-----	EX 10	
2	SCS Runoff	7.571	2	10	7,233	-----	-----	-----	EX 20	
3	Combine	27.76	2	10	27,095	1, 2	-----	-----	EX POI	
4	SCS Runoff	31.52	2	10	29,532	-----	-----	-----	DEV 10	
5	Combine	39.10	2	10	36,765	2, 4	-----	-----	DEV POI	
6	Reservoir	20.41	2	16	36,761	5	1303.46	16,224	NEW DRY DETENTION	
Cassville High School Expansion 0.5-Hour Analysis					Return Period: 100 Year			Wednesday, 03 / 29 / 2023		

Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

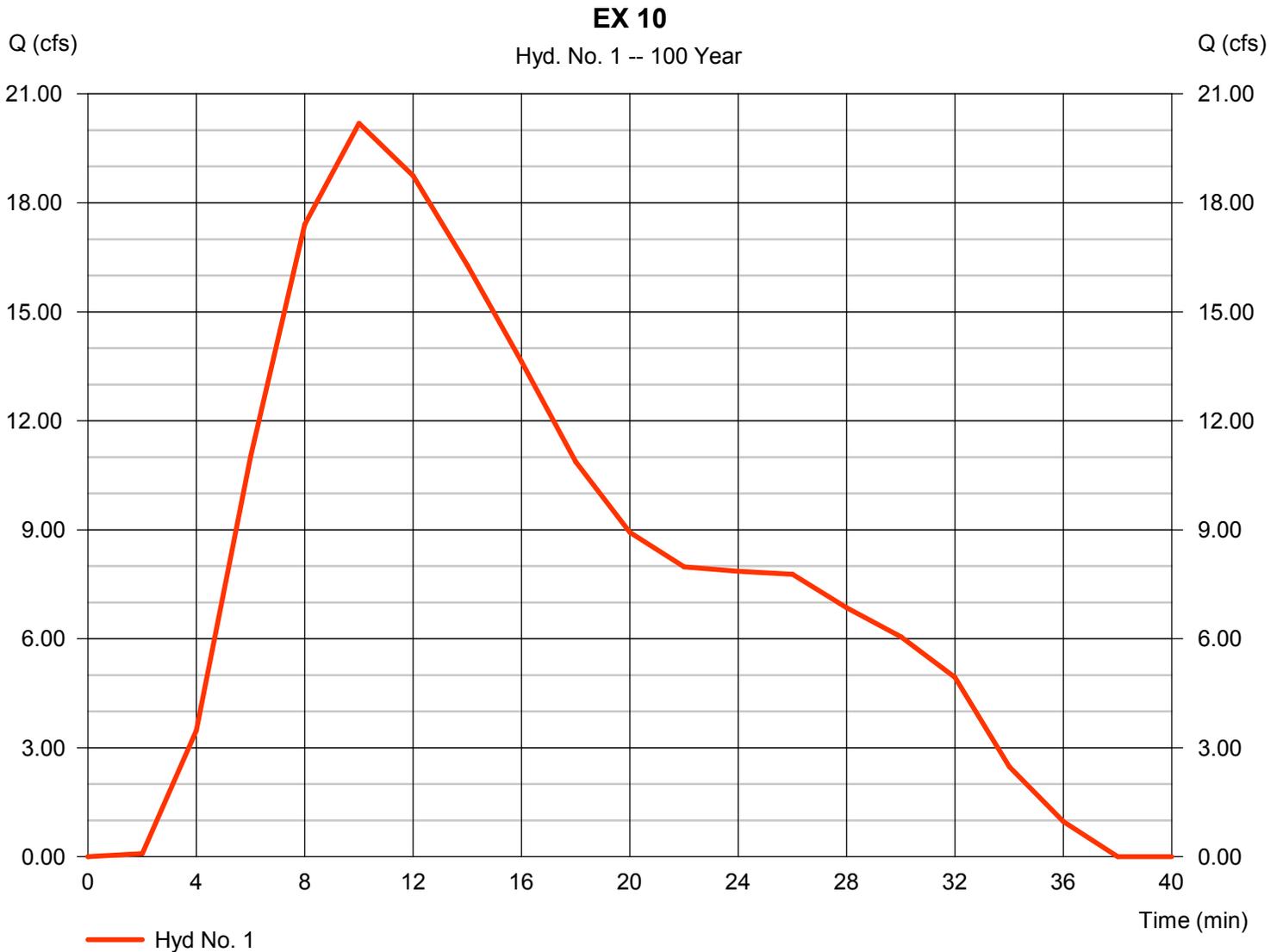
Wednesday, 03 / 29 / 2023

Hyd. No. 1

EX 10

Hydrograph type	= SCS Runoff	Peak discharge	= 20.19 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 19,862 cuft
Drainage area	= 6.510 ac	Curve number	= 82*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.36 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(2.040 x 98) + (4.470 x 74)] / 6.510



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

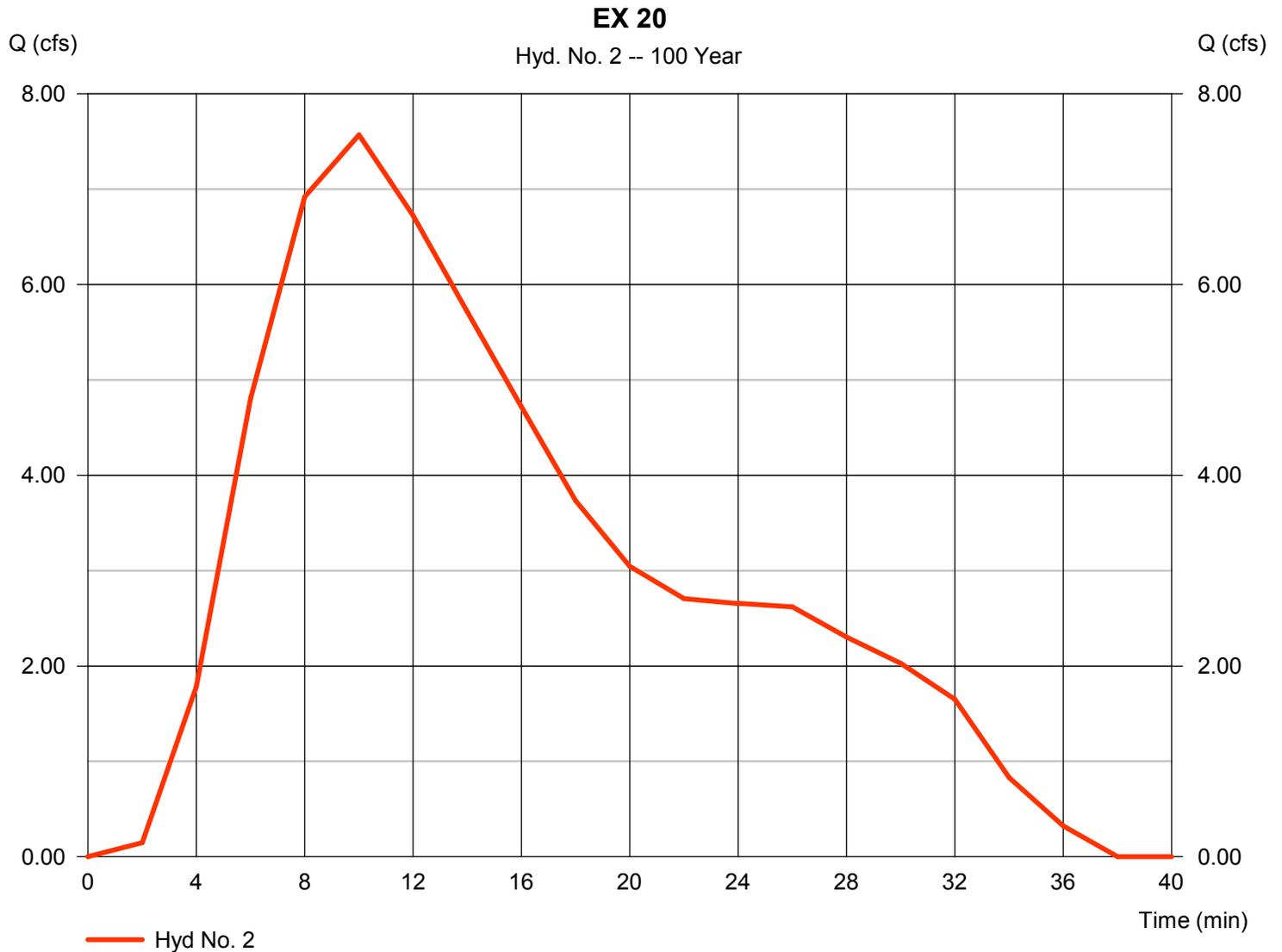
Wednesday, 03 / 29 / 2023

Hyd. No. 2

EX 20

Hydrograph type	= SCS Runoff	Peak discharge	= 7.571 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 7,233 cuft
Drainage area	= 1.990 ac	Curve number	= 85*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.36 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(0.920 x 98) + (1.070 x 74)] / 1.990



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

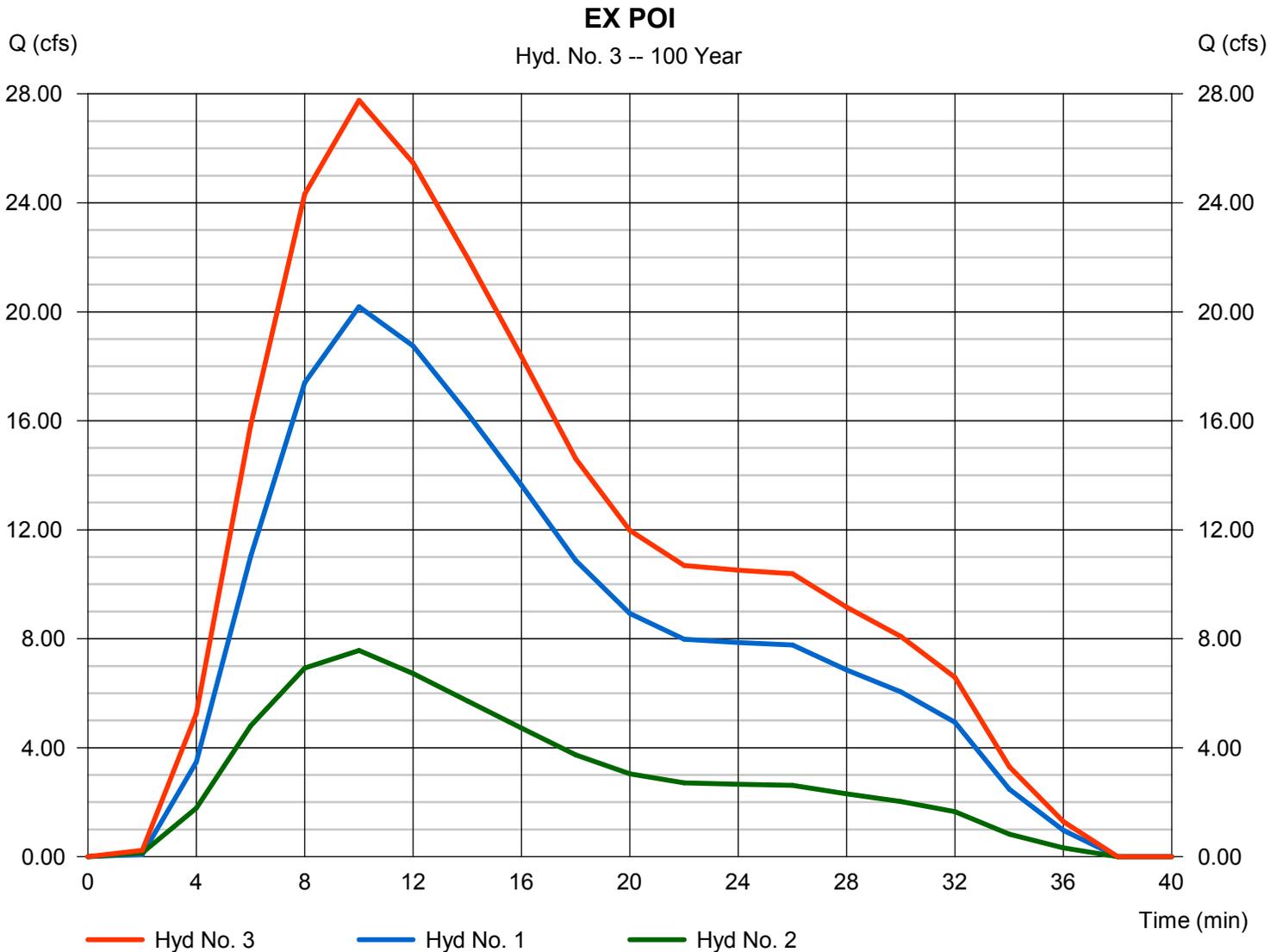
Wednesday, 03 / 29 / 2023

Hyd. No. 3

EX POI

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 1, 2

Peak discharge = 27.76 cfs
Time to peak = 10 min
Hyd. volume = 27,095 cuft
Contrib. drain. area = 8.500 ac



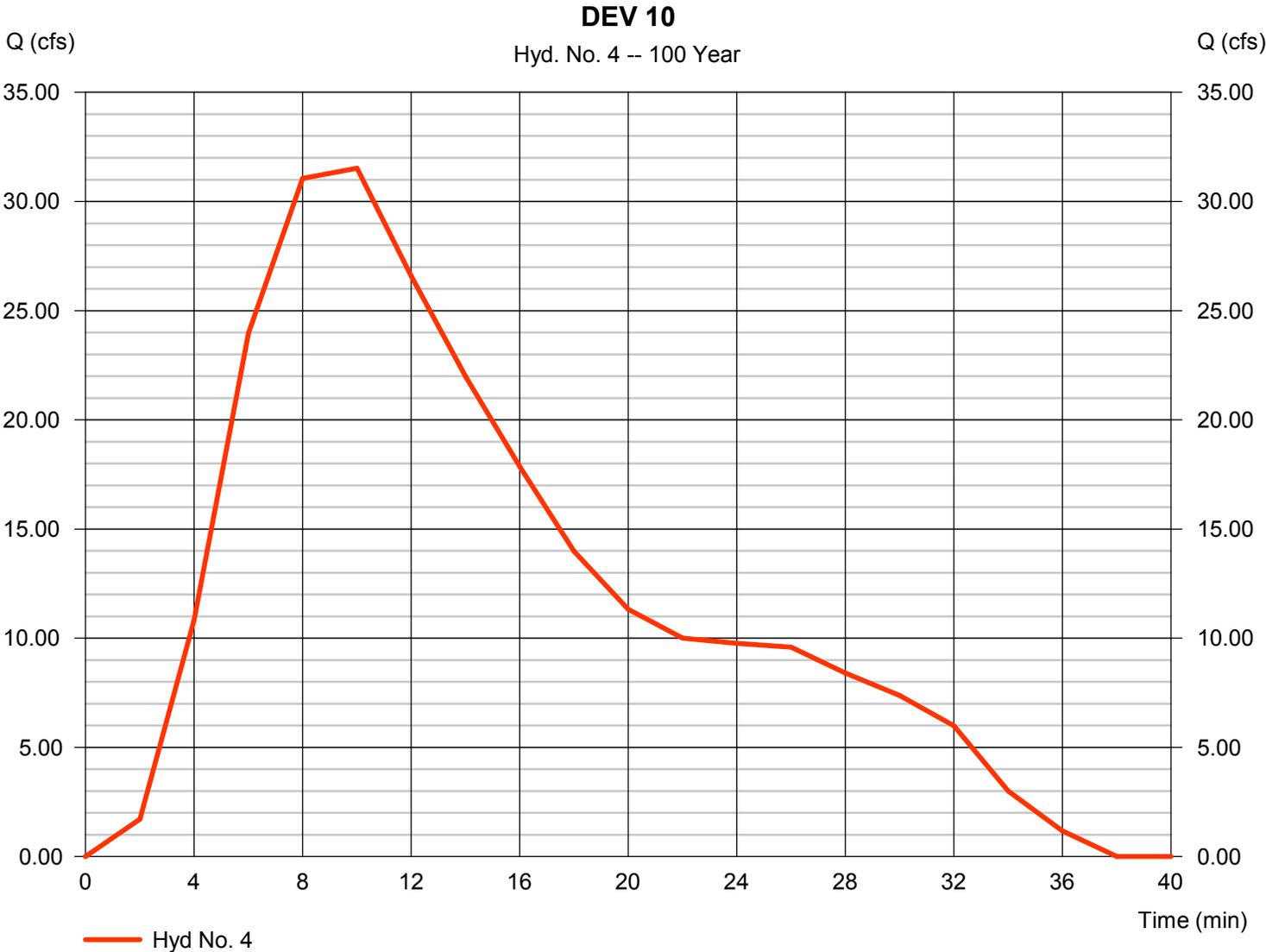
Hydrograph Report

Hyd. No. 4

DEV 10

Hydrograph type	= SCS Runoff	Peak discharge	= 31.52 cfs
Storm frequency	= 100 yrs	Time to peak	= 10 min
Time interval	= 2 min	Hyd. volume	= 29,532 cuft
Drainage area	= 6.510 ac	Curve number	= 89*
Basin Slope	= 0.0 %	Hydraulic length	= 0 ft
Tc method	= User	Time of conc. (Tc)	= 5.00 min
Total precip.	= 2.36 in	Distribution	= Huff-1st
Storm duration	= 0.50 hrs	Shape factor	= 484

* Composite (Area/CN) = [(4.180 x 98) + (2.330 x 74)] / 6.510



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

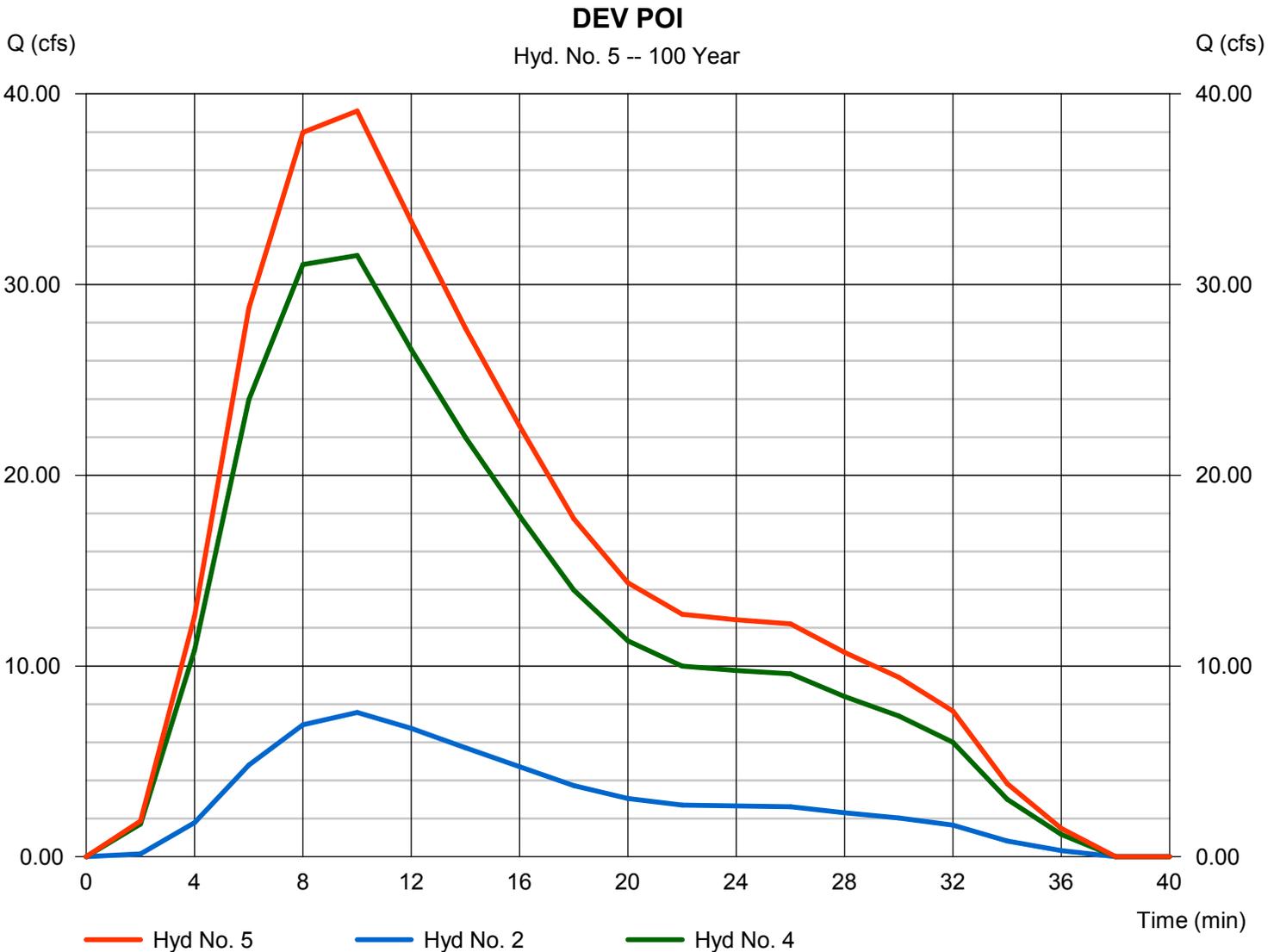
Wednesday, 03 / 29 / 2023

Hyd. No. 5

DEV POI

Hydrograph type = Combine
Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 2, 4

Peak discharge = 39.10 cfs
Time to peak = 10 min
Hyd. volume = 36,765 cuft
Contrib. drain. area = 8.500 ac



Hydrograph Report

Hydraflow Hydrographs Extension for Autodesk® Civil 3D® by Autodesk, Inc. v2022

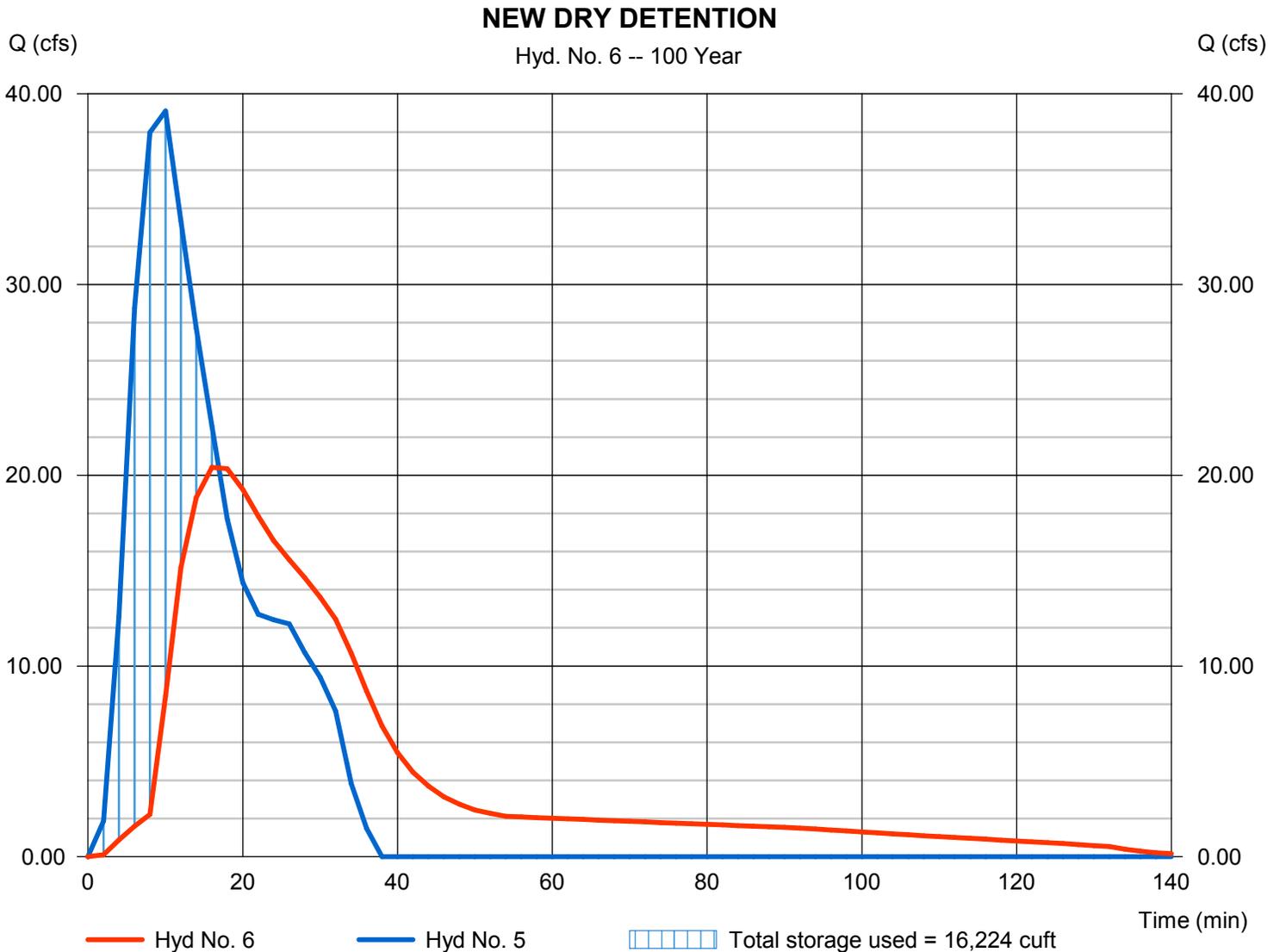
Wednesday, 03 / 29 / 2023

Hyd. No. 6

NEW DRY DETENTION

Hydrograph type	= Reservoir	Peak discharge	= 20.41 cfs
Storm frequency	= 100 yrs	Time to peak	= 16 min
Time interval	= 2 min	Hyd. volume	= 36,761 cuft
Inflow hyd. No.	= 5 - DEV POI	Max. Elevation	= 1303.46 ft
Reservoir name	= <New Pond>	Max. Storage	= 16,224 cuft

Storage Indication method used.





POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps & aeriels](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.383 (0.322-0.459)	0.440 (0.370-0.527)	0.533 (0.447-0.640)	0.611 (0.510-0.736)	0.719 (0.584-0.887)	0.804 (0.641-1.00)	0.889 (0.689-1.13)	0.976 (0.732-1.26)	1.09 (0.793-1.44)	1.18 (0.840-1.58)
10-min	0.561 (0.472-0.672)	0.644 (0.541-0.772)	0.780 (0.654-0.937)	0.894 (0.747-1.08)	1.05 (0.856-1.30)	1.18 (0.938-1.46)	1.30 (1.01-1.65)	1.43 (1.07-1.85)	1.60 (1.16-2.11)	1.73 (1.23-2.31)
15-min	0.684 (0.576-0.820)	0.785 (0.660-0.941)	0.951 (0.798-1.14)	1.09 (0.910-1.31)	1.28 (1.04-1.58)	1.44 (1.14-1.79)	1.59 (1.23-2.01)	1.74 (1.31-2.25)	1.95 (1.42-2.57)	2.11 (1.50-2.81)
30-min	1.00 (0.843-1.20)	1.15 (0.970-1.38)	1.40 (1.18-1.69)	1.62 (1.35-1.94)	1.90 (1.55-2.35)	2.13 (1.70-2.65)	2.36 (1.82-2.98)	2.58 (1.94-3.34)	2.89 (2.10-3.81)	3.12 (2.22-4.16)
60-min	1.31 (1.10-1.57)	1.51 (1.27-1.81)	1.85 (1.55-2.22)	2.15 (1.79-2.59)	2.58 (2.10-3.20)	2.92 (2.34-3.66)	3.28 (2.55-4.18)	3.66 (2.75-4.75)	4.19 (3.04-5.54)	4.60 (3.27-6.13)
2-hr	1.62 (1.37-1.92)	1.86 (1.58-2.22)	2.30 (1.94-2.74)	2.68 (2.26-3.21)	3.25 (2.68-4.02)	3.72 (3.00-4.63)	4.22 (3.30-5.34)	4.74 (3.59-6.12)	5.48 (4.02-7.21)	6.07 (4.34-8.03)
3-hr	1.81 (1.54-2.15)	2.09 (1.77-2.47)	2.57 (2.18-3.06)	3.02 (2.54-3.60)	3.69 (3.06-4.56)	4.26 (3.45-5.29)	4.86 (3.84-6.15)	5.52 (4.21-7.12)	6.46 (4.76-8.48)	7.22 (5.18-9.51)
6-hr	2.22 (1.90-2.61)	2.53 (2.16-2.98)	3.10 (2.64-3.65)	3.63 (3.08-4.28)	4.44 (3.72-5.46)	5.13 (4.20-6.35)	5.89 (4.68-7.40)	6.71 (5.16-8.60)	7.90 (5.88-10.3)	8.87 (6.42-11.6)
12-hr	2.74 (2.36-3.20)	3.09 (2.66-3.61)	3.72 (3.19-4.35)	4.30 (3.68-5.05)	5.19 (4.37-6.32)	5.94 (4.89-7.28)	6.75 (5.40-8.41)	7.64 (5.91-9.70)	8.90 (6.67-11.5)	9.92 (7.24-12.9)
24-hr	3.28 (2.84-3.80)	3.72 (3.22-4.30)	4.48 (3.87-5.19)	5.15 (4.43-5.99)	6.14 (5.17-7.36)	6.94 (5.73-8.40)	7.80 (6.26-9.60)	8.70 (6.76-10.9)	9.97 (7.51-12.8)	11.0 (8.07-14.2)
2-day	3.79 (3.30-4.35)	4.36 (3.80-5.01)	5.34 (4.64-6.14)	6.16 (5.33-7.11)	7.33 (6.19-8.68)	8.26 (6.84-9.87)	9.21 (7.43-11.2)	10.2 (7.96-12.6)	11.5 (8.73-14.6)	12.6 (9.31-16.1)
3-day	4.15 (3.63-4.74)	4.77 (4.18-5.46)	5.82 (5.08-6.66)	6.70 (5.82-7.70)	7.96 (6.75-9.38)	8.95 (7.45-10.7)	9.97 (8.08-12.1)	11.0 (8.64-13.6)	12.5 (9.46-15.7)	13.6 (10.1-17.3)
4-day	4.47 (3.93-5.09)	5.11 (4.48-5.83)	6.19 (5.41-7.07)	7.11 (6.19-8.14)	8.41 (7.15-9.88)	9.44 (7.87-11.2)	10.5 (8.52-12.7)	11.6 (9.11-14.3)	13.1 (9.97-16.4)	14.2 (10.6-18.1)
7-day	5.32 (4.69-6.02)	6.00 (5.29-6.79)	7.14 (6.28-8.10)	8.11 (7.10-9.23)	9.48 (8.10-11.1)	10.6 (8.86-12.4)	11.7 (9.53-14.0)	12.8 (10.1-15.7)	14.4 (11.0-17.9)	15.6 (11.7-19.6)
10-day	6.04 (5.35-6.81)	6.77 (5.99-7.64)	7.98 (7.04-9.02)	9.00 (7.91-10.2)	10.4 (8.95-12.1)	11.6 (9.73-13.5)	12.7 (10.4-15.2)	13.9 (11.0-16.9)	15.5 (11.9-19.2)	16.7 (12.6-21.0)
20-day	8.04 (7.17-8.99)	8.93 (7.96-9.99)	10.4 (9.24-11.7)	11.6 (10.3-13.1)	13.3 (11.5-15.3)	14.6 (12.4-16.9)	15.9 (13.1-18.8)	17.2 (13.8-20.7)	19.0 (14.7-23.3)	20.3 (15.4-25.3)
30-day	9.69 (8.68-10.8)	10.8 (9.62-12.0)	12.5 (11.1-13.9)	13.9 (12.3-15.6)	15.8 (13.7-18.0)	17.3 (14.7-19.9)	18.7 (15.5-22.0)	20.1 (16.2-24.1)	22.0 (17.1-26.9)	23.4 (17.9-29.0)
45-day	11.8 (10.6-13.1)	13.1 (11.8-14.5)	15.2 (13.6-16.9)	16.9 (15.1-18.8)	19.2 (16.6-21.7)	20.8 (17.7-23.8)	22.4 (18.6-26.1)	24.0 (19.3-28.5)	26.0 (20.3-31.6)	27.4 (21.0-33.9)
60-day	13.6 (12.3-15.0)	15.2 (13.7-16.8)	17.6 (15.8-19.5)	19.6 (17.5-21.7)	22.1 (19.2-24.9)	23.9 (20.4-27.3)	25.7 (21.4-29.8)	27.3 (22.0-32.4)	29.4 (23.0-35.5)	30.8 (23.7-37.9)

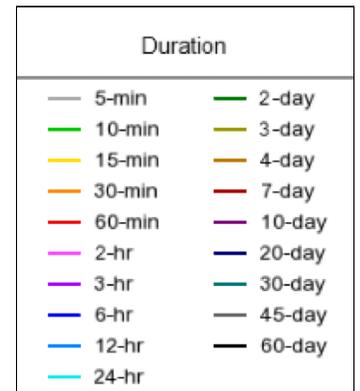
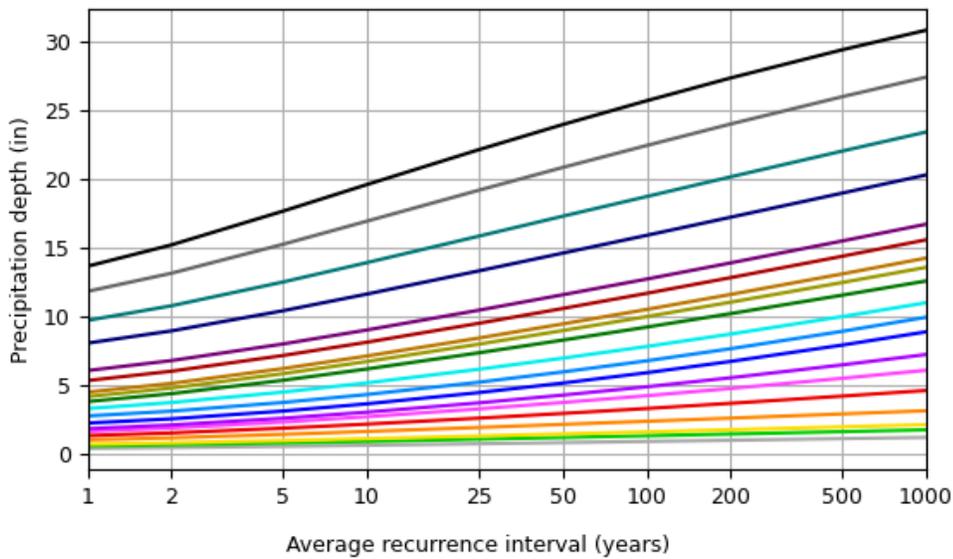
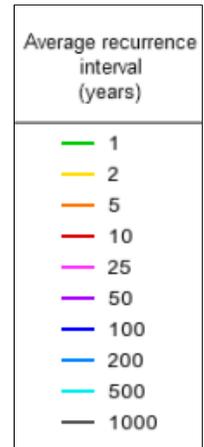
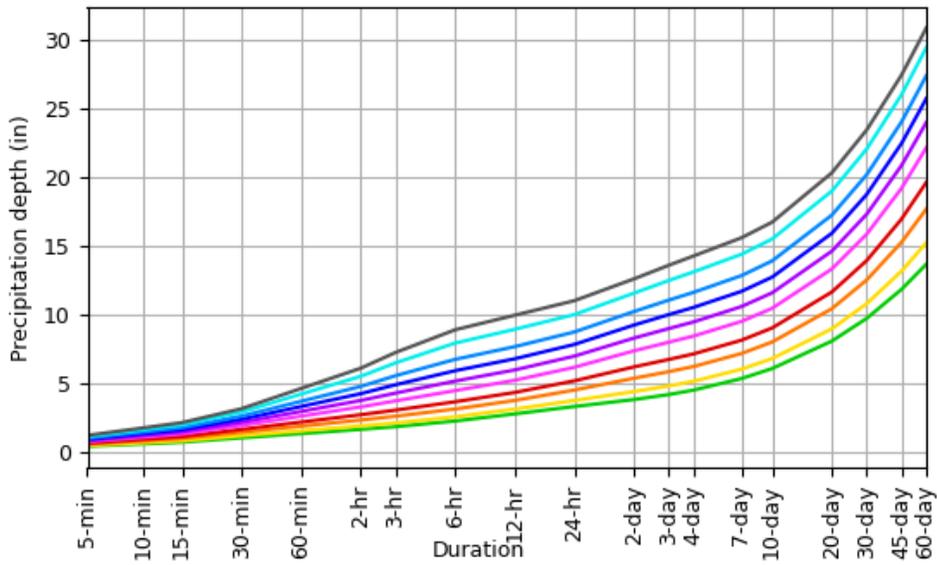
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

PF graphical

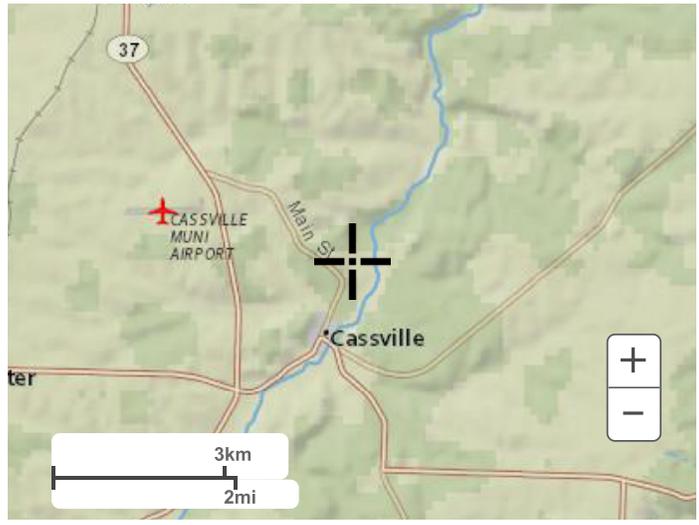
PDS-based depth-duration-frequency (DDF) curves
 Latitude: 36.6891°, Longitude: -93.8625°



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Maps & aerials

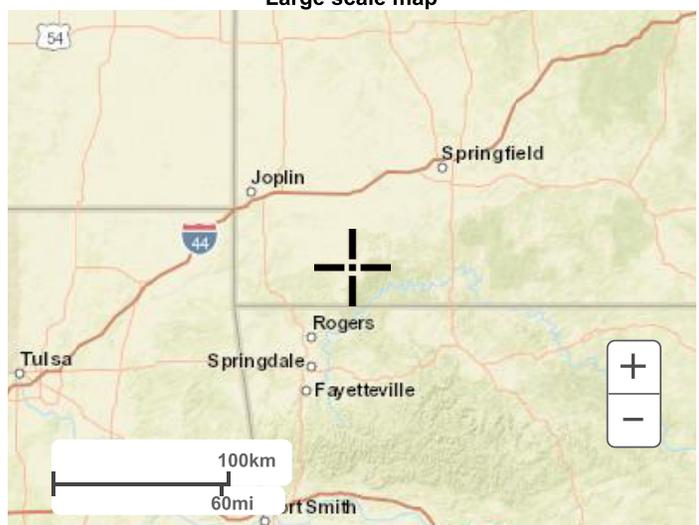
Small scale terrain



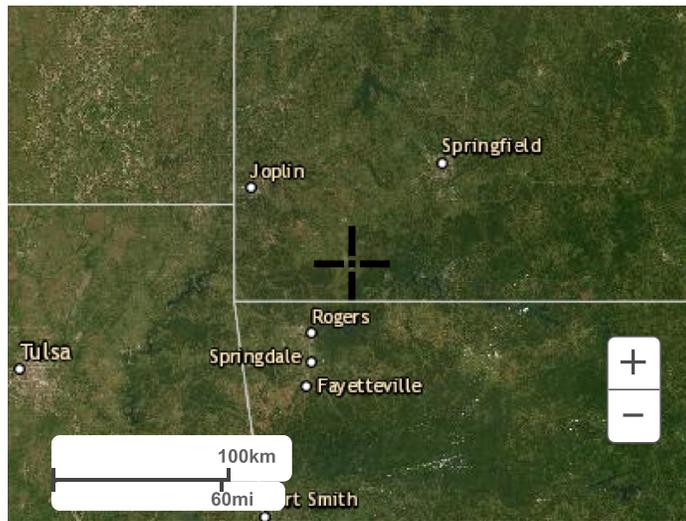
Large scale terrain



Large scale map



Large scale aerial



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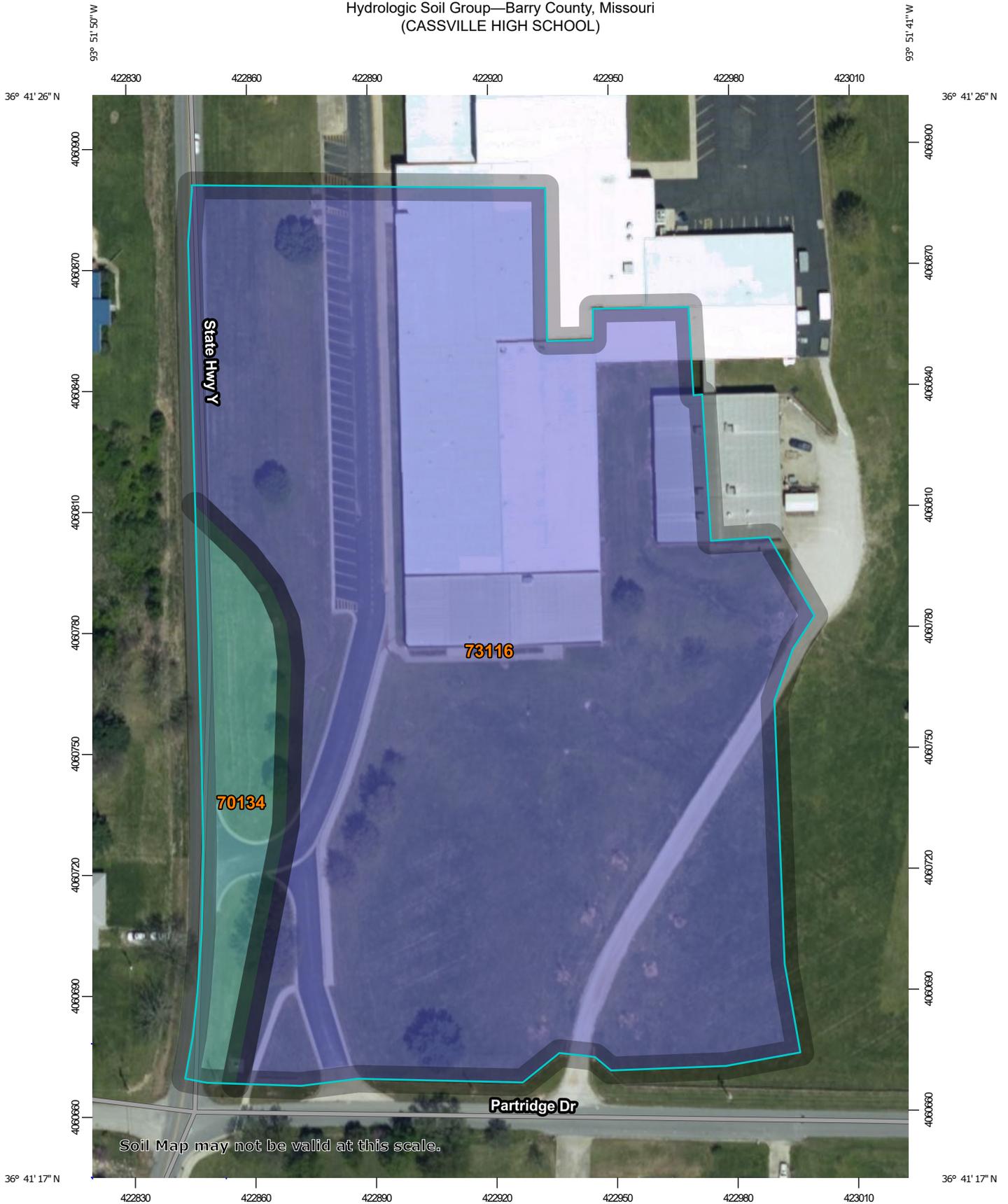
a) Select location
Move crosshair or double click

b) Click on station icon
 Show stations on map

Location information:
Name: Cassville, Missouri, USA*
Latitude: 36.6891°
Longitude: -93.8625°
Elevation: 1314.85 ft **

* Source: ESRI Maps
** Source: USGS

Hydrologic Soil Group—Barry County, Missouri
(CASSVILLE HIGH SCHOOL)



Map Scale: 1:1,310 if printed on A portrait (8.5" x 11") sheet.



Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barry County, Missouri
 Survey Area Data: Version 28, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 20, 2019—Jul 17, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
70134	Noark very gravelly silt loam, 8 to 20 percent slopes	C	0.6	8.5%
73116	Pomme silt loam, 2 to 5 percent slopes	B used C to account for disturbance	6.6	91.5%
Totals for Area of Interest			7.2	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

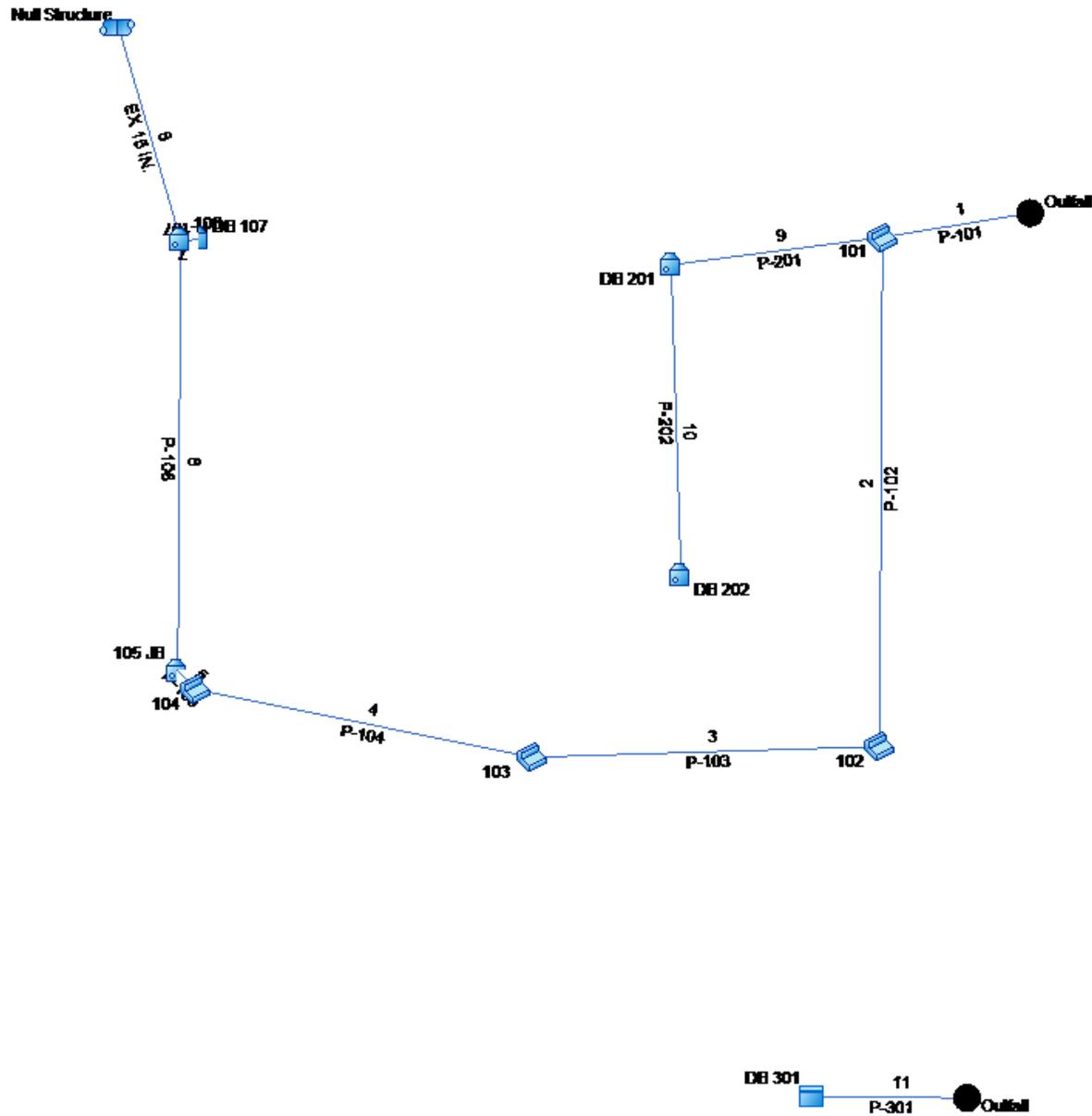
Component Percent Cutoff: None Specified

Tie-break Rule: Higher

APPENDIX B

Storm Sewer Hydraulic Calculations

Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan



Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp Line No	
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	101	4.10	0.00	4.10	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.050	0.050	0.013	0.36	7.18	0.36	7.18	0.0	Off
2	102	5.17	2.10	7.27	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.030	0.030	0.013	0.50	16.60	0.50	16.60	0.0	Off
3	103	2.31	0.00	0.21	2.10	Grate	0.0	0.00	0.00	3.00	3.00	2.020	3.00	0.020	0.020	0.013	0.07	3.38	0.07	3.26	0.0	2
4	104	0.47	0.00	0.47	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.020	0.020	0.013	0.10	4.87	0.10	4.87	0.0	Off
5	105 JB	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	106	2.07	0.00	0.00	2.07	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	DB 107	0.12	0.00	0.00	0.12	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	Null Structure	3.36*	0.00	0.00	3.36	None	0.0	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
9	DB 201	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
10	DB 202	2.07	0.00	0.00	2.07	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
11	DB 301	1.12	0.00	1.12	0.00	DrCrib	6.0	12.00	0.00	0.00	0.00	Sag	0.00	0.160	0.160	0.013	0.10	0.62	0.10	0.62	0.0	Off

Project File: Cassville PAC Storm Sewer Analysis.stm

Number of lines: 11

Run Date: 5/17/2023

NOTES: Inlet N-Values = 0.016; Intensity = 32.80 / (Inlet time + 5.80) ^ 0.69; Return period = 5 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

MyReport

Line No.	Line ID	Line Length (ft)	Line Size (in)	n-val Pipe	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	Gnd/Rim EI Dn (ft)	Gnd/Rim EI Up (ft)	HGL Dn (ft)	HGL Up (ft)	Vel Ave (ft/s)	Defl Ang (Deg)	J-Loss Coeff	Minor Loss (ft)	Energy Loss (ft)	Known Q (cfs)	Flow Rate (cfs)
1	P-101	64.990	24	0.013	1302.74	1303.16	0.65	1305.08	1306.48	1304.33	1304.75	6.59	170.629	1.48	1.00	0.420	0.00	17.64
2	P-102	221.460	24	0.013	1303.36	1305.70	1.06	1306.48	1309.53	1305.75	1306.98 j	4.99	-80.292	1.50 z	n/a	0.979	0.00	12.61
3	P-103	151.500	18	0.013	1306.20	1311.89	3.76	1309.53	1315.30	1306.98	1312.98	7.22	87.900	0.50 z	n/a	0.000	0.00	7.98
4	P-104	149.204	18	0.013	1311.99	1313.65	1.11	1315.30	1319.05	1312.98	1314.59 j	4.92	13.175	0.91 z	n/a	0.000	0.00	5.90
5	P-105	11.168	18	0.012	1313.75	1313.86	0.98	1319.05	1321.20	1314.59	1314.76	5.15	33.587	0.75 z	0.28	0.000	0.00	5.46
6	P-106	187.407	18	0.012	1313.96	1315.80	0.98	1321.20	1321.42	1314.76	1316.71	5.37	45.409	1.00 z	0.38	0.000	0.00	5.53
7	P-107	8.000	12	0.012	1318.45	1318.50	0.63	1321.42	1321.00	1318.58	1318.64	1.81	87.752	1.00 z	n/a	0.000	0.00	0.12
8	EX 15 IN.	96.278	15	0.012	1315.80	1316.08	0.29	1321.42	1321.42	1316.72	1317.00	3.48	-16.743	1.00	0.19	0.280	3.36	3.36
9	P-201	92.772	15	0.012	1303.36	1309.34	6.45	1306.48	1313.02	1305.75	1309.90 j	2.68	1.953	1.00 z	n/a	0.256	0.00	1.99
10	P-202	135.474	15	0.012	1309.54	1310.25	0.52	1313.02	1313.96	1310.10	1310.82	3.84	-84.316	1.00 z	n/a	0.000	0.00	2.07
11	P-301	67.150	15	0.013	1306.50	1306.85	0.52	1307.02	1310.69	1306.92	1307.27	3.09	-179.419	1.00	0.15	0.342	0.00	1.12

Project File: Cassville PAC Storm Sewer Analysis.stm

Number of lines: 11

Date: 5/17/2023

NOTES: ** Critical depth

Capac Full (cfs)	
18.18	
23.25	
20.35	
11.08	
11.29	
11.27	
3.05	
3.77	
17.76	
5.06	
4.66	

Project File: Cassville PAC Storm Sewer Analysis.stm	Number of lines: 11	Date: 5/17/2023
--	---------------------	-----------------

NOTES: ** Critical depth

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp Line No	
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	101	5.51	0.00	5.51	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.050	0.050	0.013	0.42	8.43	0.42	8.43	0.0	Off
2	102	6.96	3.25	10.22	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.030	0.030	0.013	0.94	31.32	0.94	31.32	0.0	Off
3	103	3.11	0.00	-0.14	3.25	Grate	0.0	0.00	0.00	3.00	3.00	2.020	3.00	0.020	0.020	0.013	0.08	3.78	0.08	3.84	0.0	2
4	104	0.64	0.00	0.64	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.020	0.020	0.013	0.11	5.61	0.11	5.61	0.0	Off
5	105 JB	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	106	2.78	0.00	0.00	2.78	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	DB 107	0.16	0.00	0.00	0.16	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	Null Structure	3.36*	0.00	0.00	3.36	None	0.0	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
9	DB 201	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
10	DB 202	2.78	0.00	0.00	2.78	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
11	DB 301	1.51	0.00	1.51	0.00	DrCrib	6.0	12.00	0.00	0.00	0.00	Sag	0.00	0.160	0.160	0.013	0.12	0.75	0.12	0.75	0.0	Off

Project File: Cassville PAC Storm Sewer Analysis.stm

Number of lines: 11

Run Date: 5/17/2023

NOTES: Inlet N-Values = 0.016; Intensity = 33.70 / (Inlet time + 4.10) ^ 0.62; Return period = 25 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Line No.	Line ID	Line Length (ft)	Line Size (in)	n-val Pipe	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	Gnd/Rim EI Dn (ft)	Gnd/Rim EI Up (ft)	HGL Dn (ft)	HGL Up (ft)	Vel Ave (ft/s)	Defl Ang (Deg)	J-Loss Coeff	Minor Loss (ft)	Energy Loss (ft)	Known Q (cfs)	Flow Rate (cfs)
1	P-101	64.990	24	0.013	1302.74	1303.16	0.65	1305.08	1306.48	1304.43	1305.24	7.55	170.629	1.48	1.18	0.626	0.00	22.48
2	P-102	221.460	24	0.013	1303.36	1305.70	1.06	1306.48	1309.53	1306.42	1307.37	5.31	-80.292	1.50 z	0.73	1.053	0.00	15.73
3	P-103	151.500	18	0.013	1306.20	1311.89	3.76	1309.53	1315.30	1308.11	1313.08 j	5.88	87.900	0.50 z	n/a	1.295	0.00	9.57
4	P-104	149.204	18	0.013	1311.99	1313.65	1.11	1315.30	1319.05	1313.08	1314.66 j	5.14	13.175	0.91 z	n/a	0.000	0.00	6.78
5	P-105	11.168	18	0.012	1313.75	1313.86	0.98	1319.05	1321.20	1314.66	1314.82	5.35	33.587	0.75 z	0.31	0.000	0.00	6.18
6	P-106	187.407	18	0.012	1313.96	1315.80	0.98	1321.20	1321.42	1314.82	1316.77	5.60	45.409	1.00 z	n/a	0.000	0.00	6.28
7	P-107	8.000	12	0.012	1318.45	1318.50	0.63	1321.42	1321.00	1318.60	1318.66	1.96	87.752	1.00 z	n/a	0.000	0.00	0.16
8	EX 15 IN.	96.278	15	0.012	1315.80	1316.08	0.29	1321.42	1321.42	1316.77	1317.01	3.35	-16.743	1.00	0.18	0.259	3.36	3.36
9	P-201	92.772	15	0.012	1303.36	1309.34	6.45	1306.48	1313.02	1306.42	1310.00 j	3.15	1.953	1.00 z	n/a	0.300	0.00	2.69
10	P-202	135.474	15	0.012	1309.54	1310.25	0.52	1313.02	1313.96	1310.20	1310.92	4.19	-84.316	1.00 z	0.27	0.000	0.00	2.78
11	P-301	67.150	15	0.013	1306.50	1306.85	0.52	1307.02	1310.69	1306.99	1307.34	3.39	-179.419	1.00	0.18	0.350	0.00	1.51

Project File: Cassville PAC Storm Sewer Analysis.stm

Number of lines: 11

Date: 5/17/2023

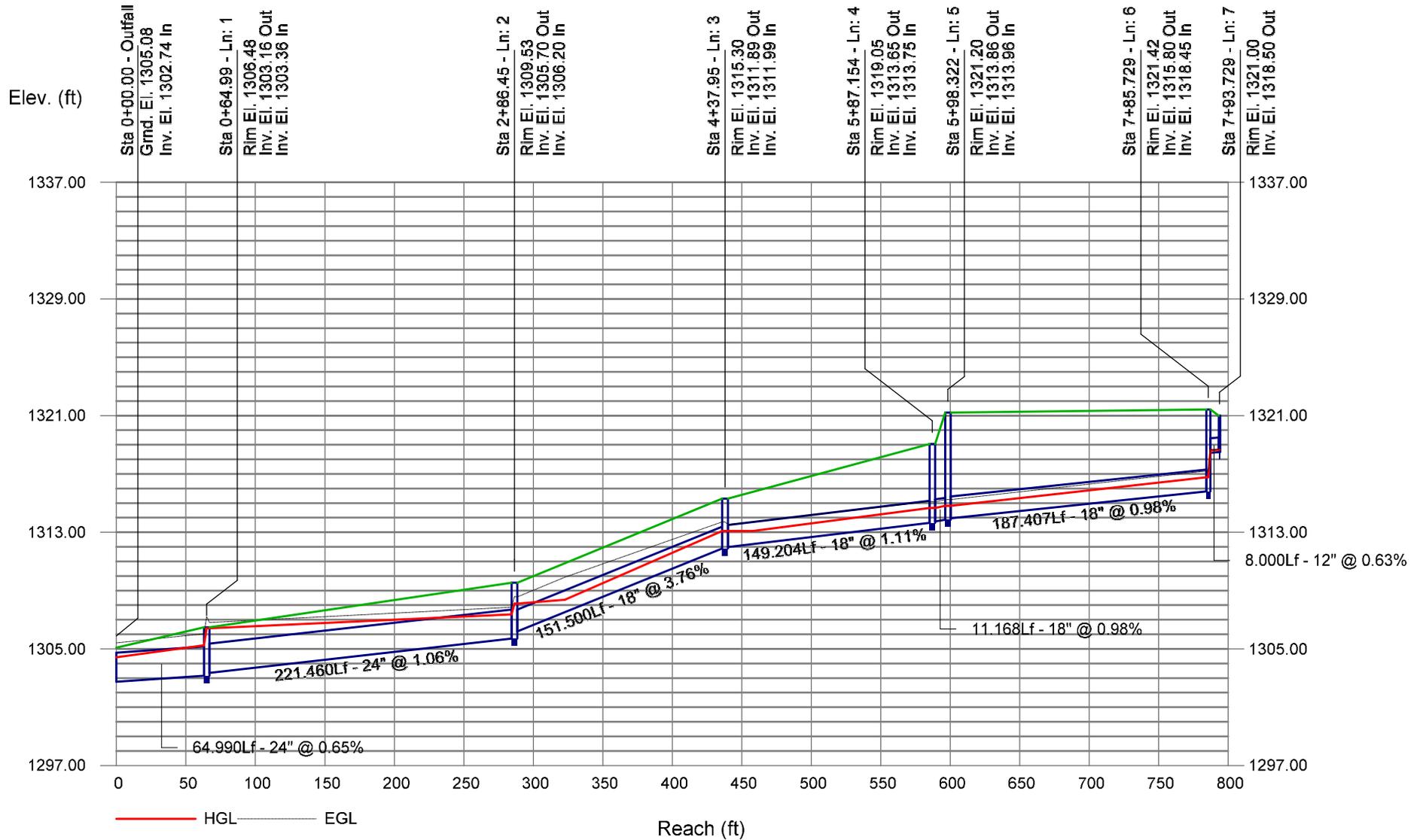
NOTES: ** Critical depth

Capac Full (cfs)	
18.18	
23.25	
20.35	
11.08	
11.29	
11.27	
3.05	
3.77	
17.76	
5.06	
4.66	

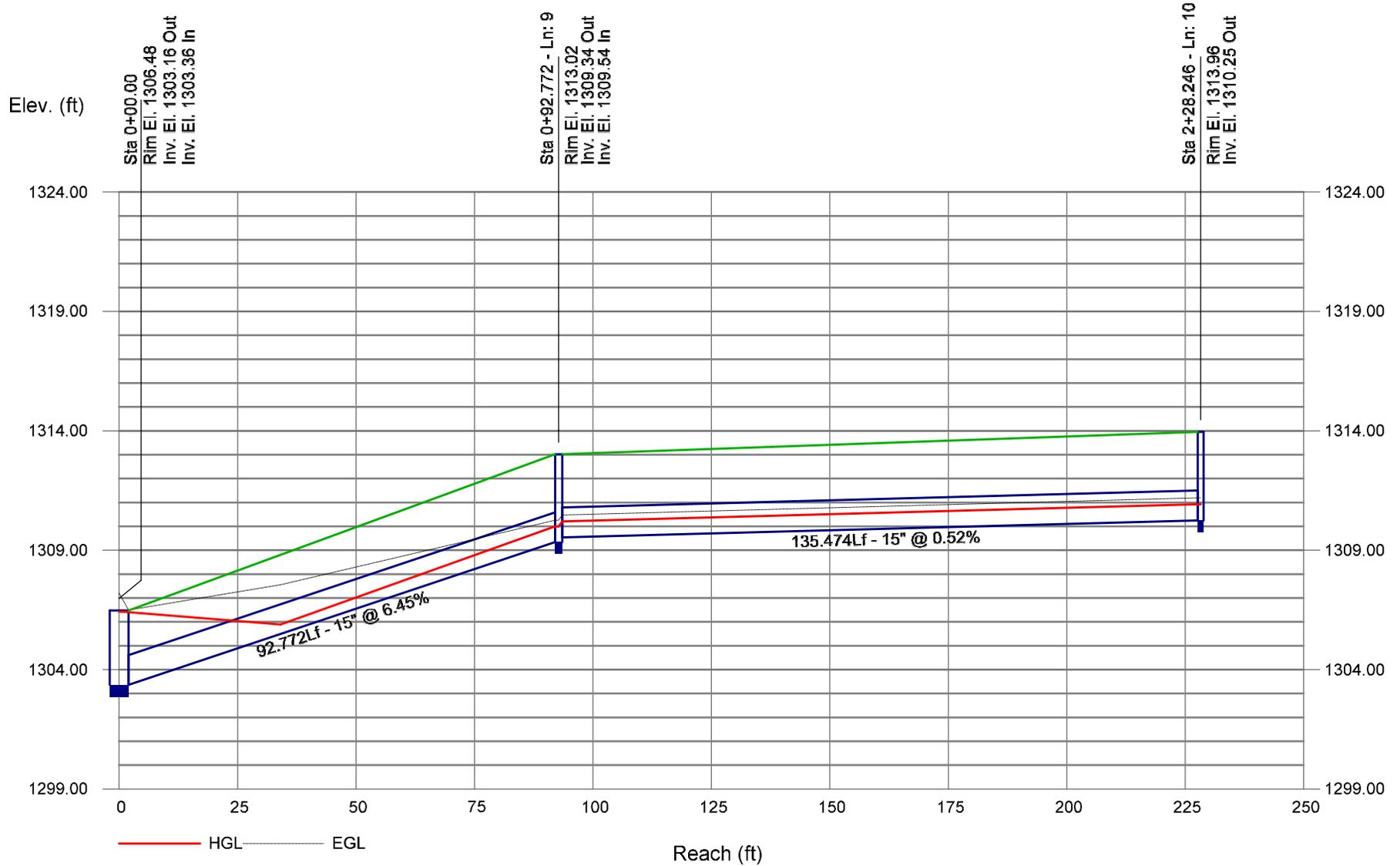
Project File: Cassville PAC Storm Sewer Analysis.stm	Number of lines: 11	Date: 5/17/2023
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NOTES: ** Critical depth

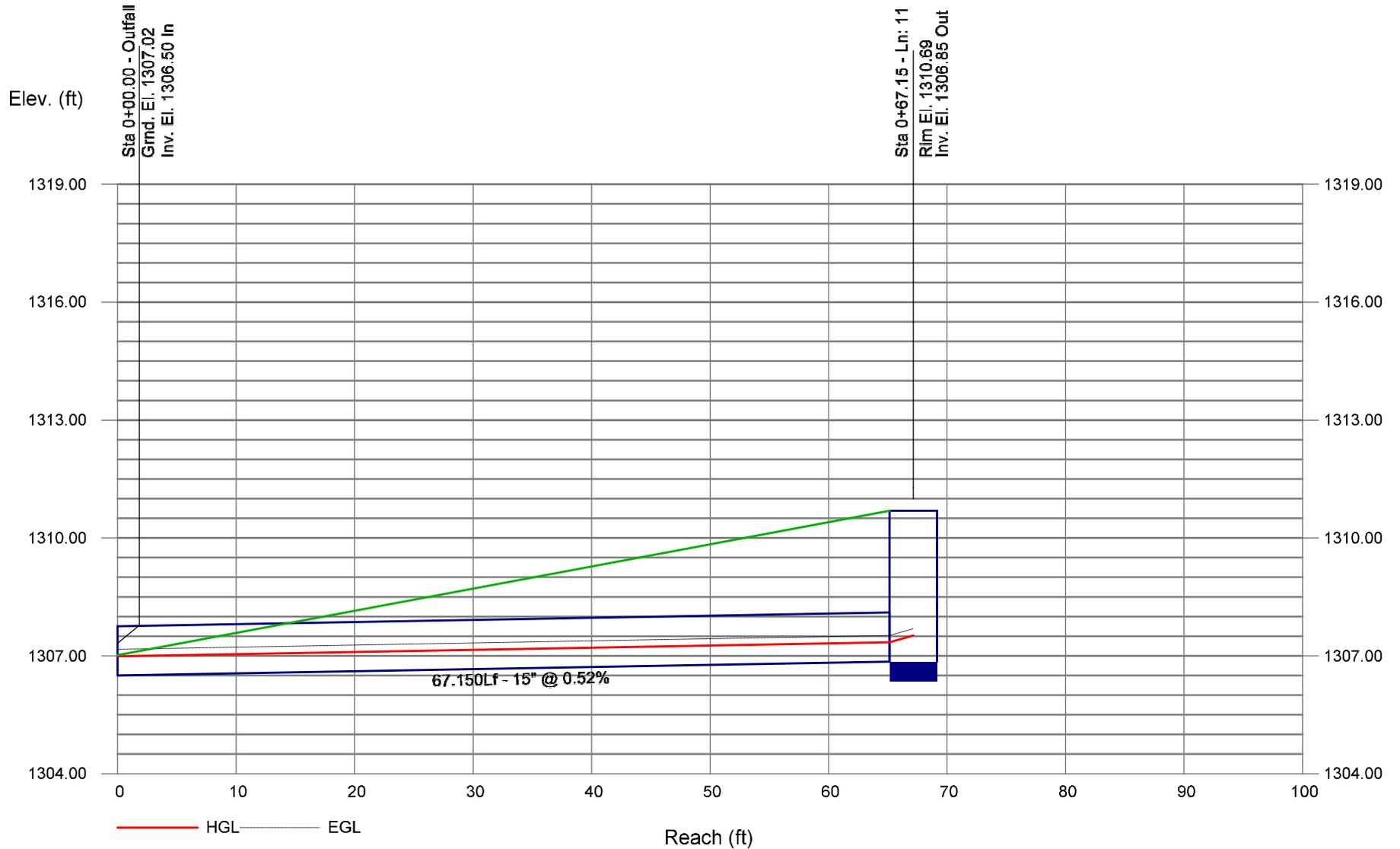
Storm Sewer Profile



Storm Sewer Profile



Storm Sewer Profile



Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter						Inlet			Byp Line No	
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)		Depr (in)
1	101	6.84	0.00	6.84	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.050	0.050	0.013	0.48	9.52	0.48	9.52	0.0	Off
2	102	8.63	4.45	13.08	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.030	0.030	0.013	1.51	50.41	1.51	50.41	0.0	Off
3	103	3.86	0.00	-0.59	4.45	Grate	0.0	0.00	0.00	3.00	3.00	2.020	3.00	0.020	0.020	0.013	0.08	4.09	0.09	4.32	0.0	2
4	104	0.79	0.00	0.79	0.00	Grate	0.0	0.00	2.01	3.00	3.00	Sag	3.00	0.020	0.020	0.013	0.12	6.25	0.12	6.25	0.0	Off
5	105 JB	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
6	106	3.45	0.00	0.00	3.45	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
7	DB 107	0.19	0.00	0.00	0.19	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
8	Null Structure	3.36*	0.00	0.00	3.36	None	0.0	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
9	DB 201	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	0.000	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
10	DB 202	3.45	0.00	0.00	3.45	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.013	0.00	0.00	0.00	0.00	0.0	Off
11	DB 301	1.87	0.00	1.87	0.00	DrCrib	6.0	12.00	0.00	0.00	0.00	Sag	0.00	0.160	0.160	0.013	0.14	0.87	0.14	0.87	0.0	Off

Project File: Cassville PAC Storm Sewer Analysis.stm

Number of lines: 11

Run Date: 5/17/2023

NOTES: Inlet N-Values = 0.016; Intensity = 31.94 / (Inlet time + 2.30) ^ 0.55; Return period = 100 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Line No.	Line ID	Line Length (ft)	Line Size (in)	n-val Pipe	Invert Dn (ft)	Invert Up (ft)	Line Slope (%)	Gnd/Rim EI Dn (ft)	Gnd/Rim EI Up (ft)	HGL Dn (ft)	HGL Up (ft)	Vel Ave (ft/s)	Defl Ang (Deg)	J-Loss Coeff	Minor Loss (ft)	Energy Loss (ft)	Known Q (cfs)	Flow Rate (cfs)
1	P-101	64.990	24	0.013	1302.74	1303.16	0.65	1305.08	1306.48	1304.55	1305.54	8.83	170.629	1.48	1.70	0.872	0.00	27.04
2	P-102	221.460	24	0.013	1303.36	1305.70	1.06	1306.48	1309.53	1307.25	1308.75	5.94	-80.292	1.50	0.82	1.506	0.00	18.65
3	P-103	151.500	18	0.013	1306.20	1311.89	3.76	1309.53	1315.30	1309.57	1313.16 j	6.58	87.900	0.50 z	n/a	1.629	0.00	11.04
4	P-104	149.204	18	0.013	1311.99	1313.65	1.11	1315.30	1319.05	1313.16	1314.72 j	5.39	13.175	0.91 z	n/a	0.000	0.00	7.60
5	P-105	11.168	18	0.012	1313.75	1313.86	0.98	1319.05	1321.20	1314.72	1314.87	5.54	33.587	0.75 z	n/a	0.000	0.00	6.85
6	P-106	187.407	18	0.012	1313.96	1315.80	0.98	1321.20	1321.42	1314.87	1316.82	5.83	45.409	1.00 z	n/a	0.000	0.00	6.99
7	P-107	8.000	12	0.012	1318.45	1318.50	0.63	1321.42	1321.00	1318.62	1318.68	2.09	87.752	1.00 z	n/a	0.000	0.00	0.19
8	EX 15 IN.	96.278	15	0.012	1315.80	1316.08	0.29	1321.42	1321.42	1316.82	1317.04	3.22	-16.743	1.00	0.17	0.238	3.36	3.36
9	P-201	92.772	15	0.012	1303.36	1309.34	6.45	1306.48	1313.02	1307.25	1310.07 j	3.57	1.953	1.00 z	n/a	0.353	0.00	3.33
10	P-202	135.474	15	0.012	1309.54	1310.25	0.52	1313.02	1313.96	1310.30	1311.01 j	4.44	-84.316	1.00	n/a	0.708	0.00	3.45
11	P-301	67.150	15	0.013	1306.50	1306.85	0.52	1307.02	1310.69	1307.04	1307.41	3.58	-179.419	1.00	0.19	0.349	0.00	1.87

Project File: Cassville PAC Storm Sewer Analysis.stm

Number of lines: 11

Date: 5/17/2023

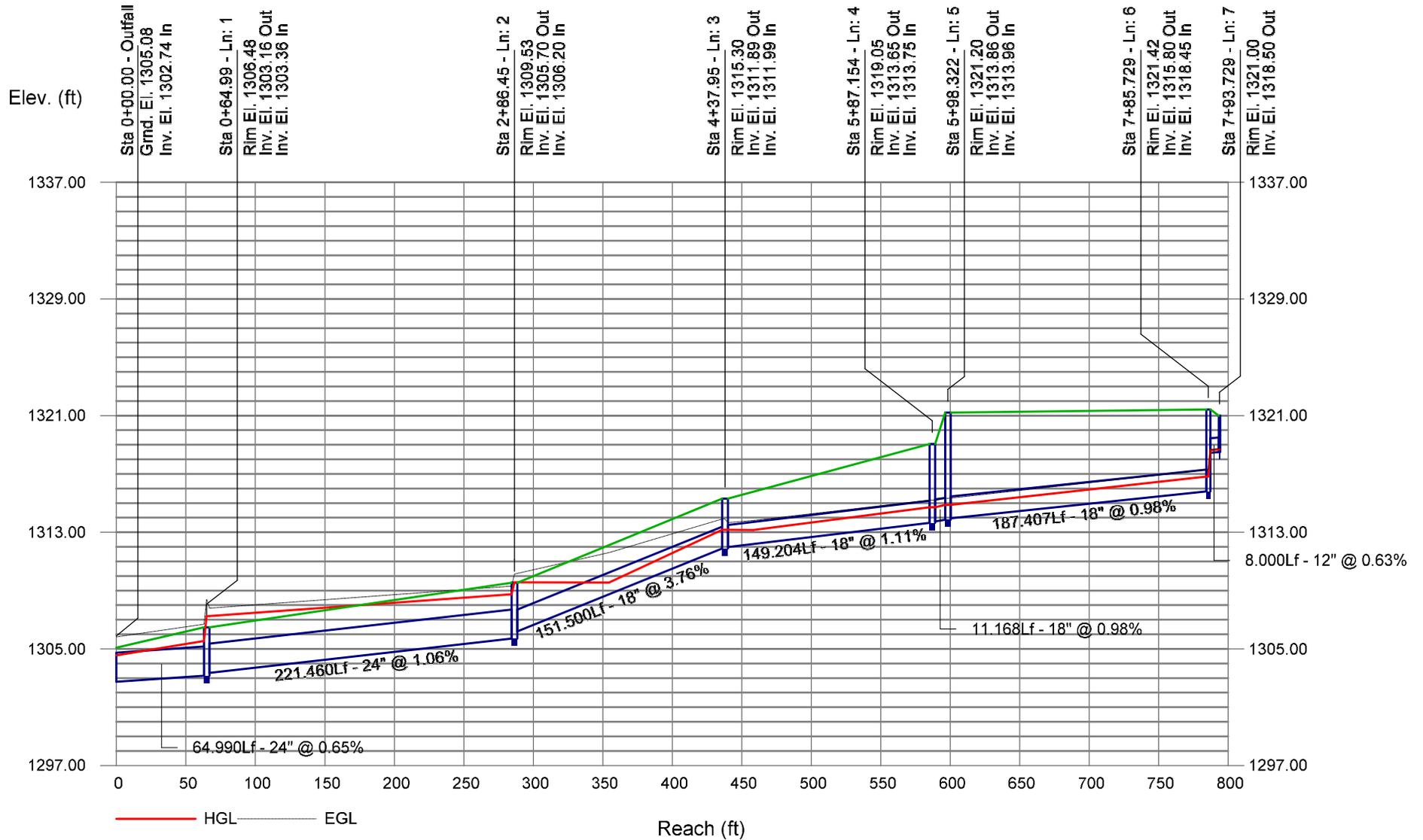
NOTES: ** Critical depth

Capac Full (cfs)	
18.18	
23.25	
20.35	
11.08	
11.29	
11.27	
3.05	
3.77	
17.76	
5.06	
4.66	

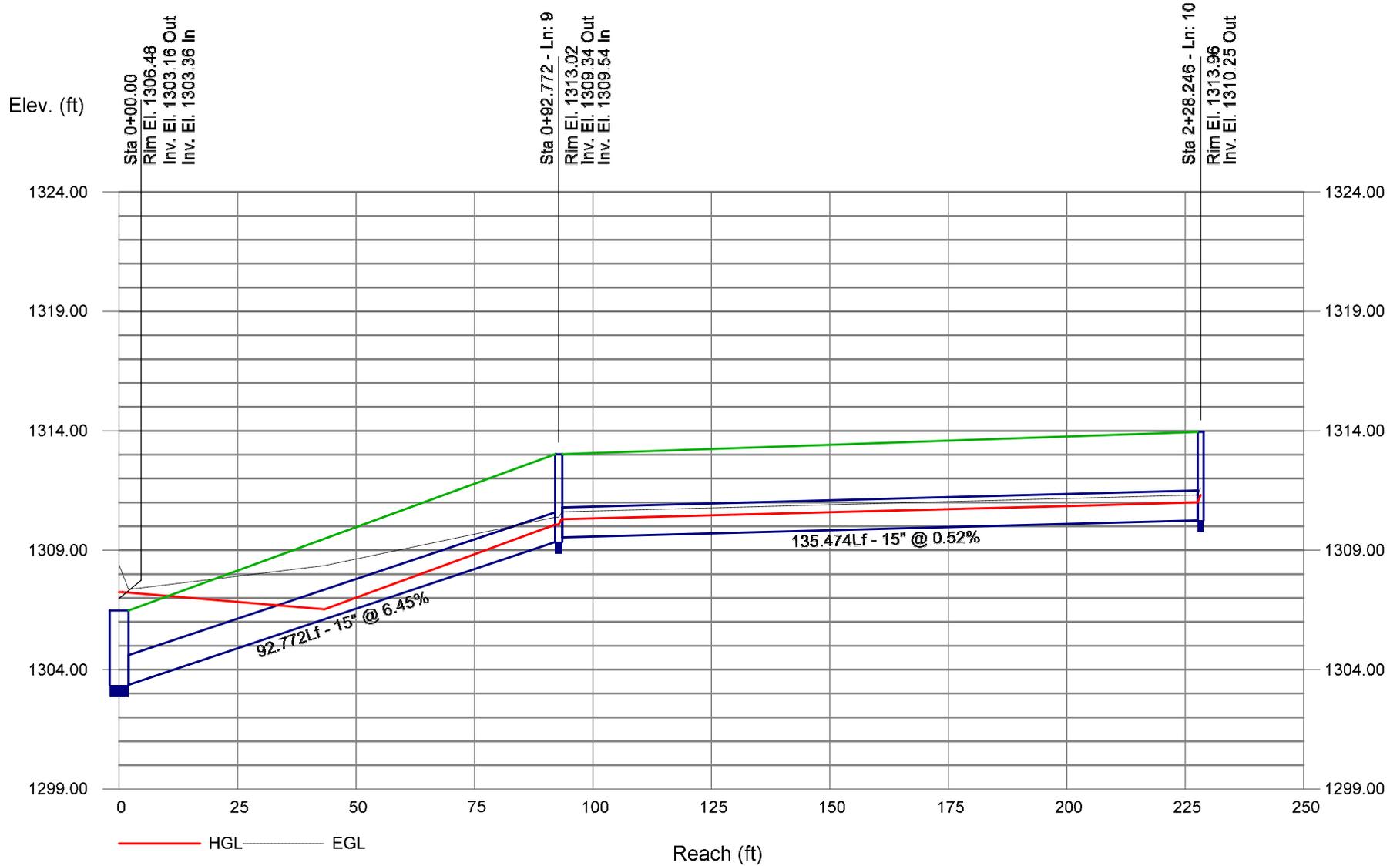
Project File: Cassville PAC Storm Sewer Analysis.stm	Number of lines: 11	Date: 5/17/2023
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NOTES: ** Critical depth

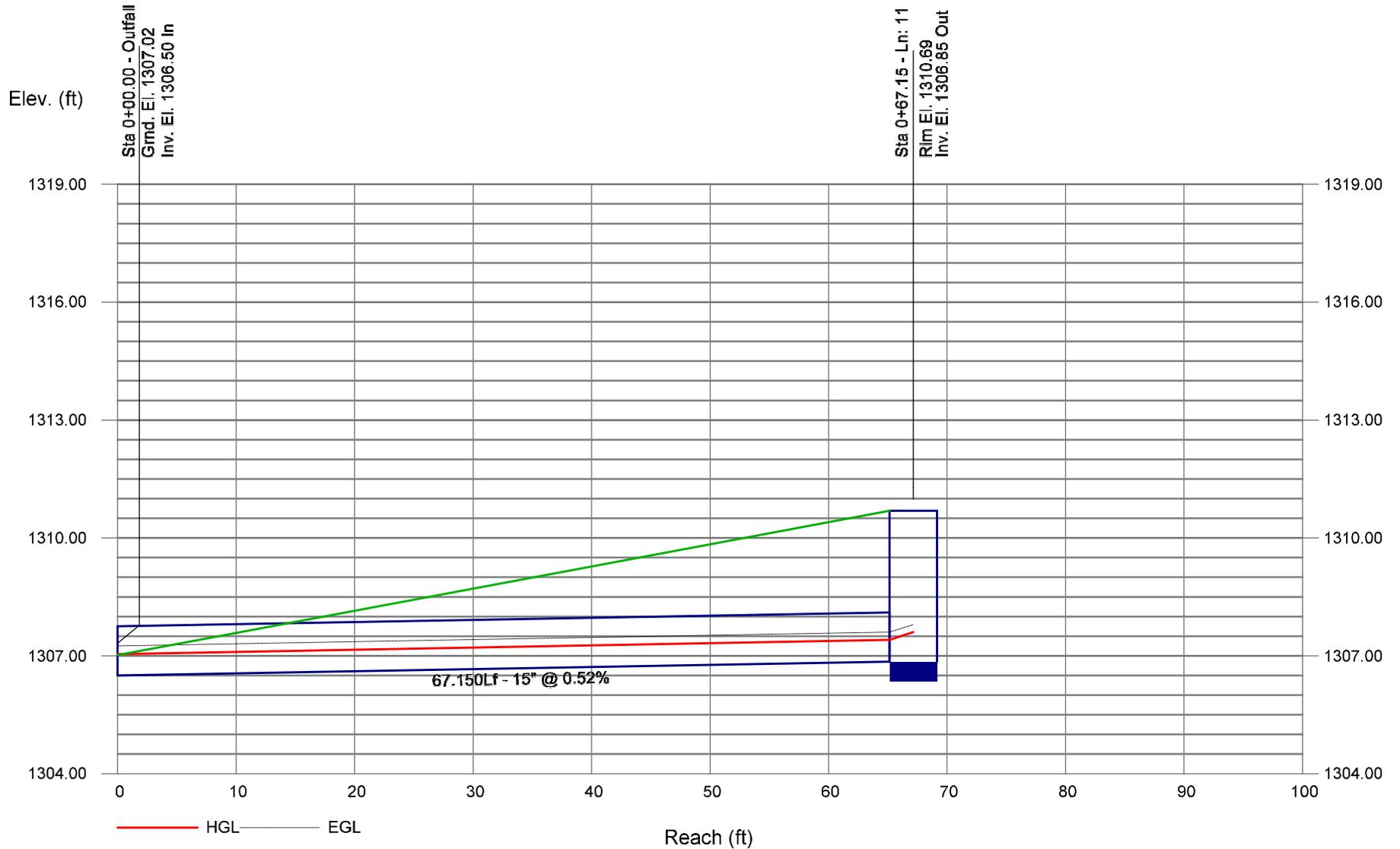
Storm Sewer Profile



Storm Sewer Profile



Storm Sewer Profile



FINAL DRAINAGE REPORT
CASSVILLE HIGH SCHOOL PERFORMING ARTS CENTER

Cassville, Missouri – 2023

May 2023

Olsson Project 021-06600



SWPPP MEMORANDUM

<input type="checkbox"/>	Overnight
<input type="checkbox"/>	Regular Mail
<input type="checkbox"/>	Hand Delivery
<input type="checkbox"/>	Other: _____

TO:	Cassville R-IV Public Schools
FROM:	Olsson
RE:	
DATE:	5/19/2023
PROJECT #:	021-06600
PHASE:	400
TASK:	400401

Dear Permittee,

We are submitting this letter to advise you of the requirements to complete and maintain the Stormwater Pollution Prevention Plan (SWPPP). Once you have read this document, please sign at the bottom, scan and send a copy back to me for our records.

As the Permittee of the site, you are responsible for updating and maintaining the SWPPP and specifically, but not limited to, the following sections. The site SWPPP must be regularly updated and maintained throughout the life of the project. The below SWPPP binder sections are, at a minimum, required to be reviewed and updated:

Section/Part	Description
Cover page	Sign SWPPP Certification
Section 1	
Delegation Statement	If applicable, designate a duly authorized representative with day to day operational control to manage onsite SWPPP matters
Contractor/Subcontractor Certifications	Have contractors/subcontractors sign certifications stating they will comply with SWPPP requirements and store in SWPPP binder
Section 2	
Permit Authorization	If permit authorization is received after delivery of SWPPP, insert permit authorization into this section once received
Section 3	
1.0	Enter contact information for any missing contractors not yet assigned during SWPPP development
Section 5	
BMP Tracking Map and Land Disturbance Tracking Log	Regular updates to the BMP Tracking Map and Land Disturbance Tracking Log is required to comply with the general permit

Section 6	
Site sign	A sign must be posted onsite near the main entrance. See detail, general permit in Section 2 or 7.1 of the Narrative in Section 3 of the binder for specific requirements
BMP specification and detail sheets	If additional BMPs not called for in the original design are necessary, add detail and specification information to this section
Section 7	
Log of Amendments	When amendments or modifications to the SWPPP are required they should be logged here
Section 9	
Spill Report Forms	If reportable spills occur onsite they should be documented with these forms
Section 12	
Inspection Reports	When completed routine and/or rain event inspection reports should be stored here
Log of inspections	A log of inspections is required to be kept

Section 1- Delegation of Authority and Contractor/Subcontractor Certification

As the primary Permittee, you are responsible for assuring adherence to the Erosion and Sediment Control Plan and the proper installation and maintenance of BMPs (structural and non-structural) on the site. Should the you wish to delegate control to the Operator or another qualified individual, the Delegation of Authority Form must be signed, naming the person or position as a duly authorized representative. Contractors and/or Subcontractors operating on the site should also sign the certifications located in this section to certify they are aware of and will adhere to the requirements of the SWPPP.

Section 3- SWPPP Certification and SWPPP Narrative

The Permittee is required to sign the SWPPP Certification on the title page of the SWPPP narrative. Should any information contained in the narrative change it is the duty of the Permittee or their duly authorized representative to update the narrative and document the changes in the SWPPP Amendment Log located in Section 7 of the SWPPP binder.

Section 5- Active SWPPP Map and Grading, Stabilization and Dewatering Activities Log

The Permittee or their duly authorized representative is required to keep the Active SWPPP Map current with locations of BMPs with dates of installation and removal, locations of pollution generating activities (i.e. concrete washouts, portable toilets, dumpsters, etc.) and areas of the project that have been completed and stabilized. The Grading, Stabilization and Dewatering Activities Log may be used in conjunction with the Active SWPPP Map to document dates of major grading actives, stabilization practices and dewatering activities.

Section 7- SWPPP Amendment Log

The Permittee is responsible for keeping the SWPPP up to date as site conditions change through the project. Should the SWPPP need to be modified or amended, the Amendment Log should be used to track required changes and updates to the SWPPP, including but not limited to; additions of new BMPs, replacement of failed BMPs, significant changes in or the timing of the project, changes in personnel, inspection and maintenance procedures, updates to site, etc.



At times amendments or modifications to the SWPPP require other sections of the document to be modified (i.e. documents inserted or altered) and these modifications should also be tracked on the SWPPP Amendment Log.

Section 8- Local Regulations and Additional Permits

Local regulations can be found in this section that may be more stringent and differ from the Missouri State Operating permit. It is the responsibility of the Permittee to ensure the site is adhering to the more stringent of the regulations. Additional permits (i.e. grading permits, building permits, ACOE permits, etc.) may be placed in this section for reference only and ease of access.

Section 12 – Inspection Reports

The Permittee is responsible for insuring routine site inspections are conducted at the frequency stated in the SWPPP narrative. Site inspections of the erosion and sediment control, pollution prevention and, when applicable, stormwater management BMPs are required to maintain compliance with the construction general permit. Documentation of inspections should be performed by qualified personnel at the frequency stated in the SWPPP narrative and stored in this section of the SWPPP binder unless otherwise noted in the SWPPP. In Missouri, a log of inspection reports is also required to be maintained in the SWPPP and can be found in this section.

***Note: SWPPP Section 14- Notice of Termination must be completed and submitted to the MDNR when the requirements of terminating the Missouri State Operating Permit are met (permit included in Section 2 of the SWPPP). A copy of the signed document should be placed in this section and all SWPPP records retained for 3 years after the date of acceptance of the Notice of Termination. A link to the MoGEM system where the form must be completed can be found on the coversheet of Section 14.*

Please don't hesitate to contact me with questions or concerns,

Brock Stringer
550 E. St. Louis Street
417.890.8802
bstringer@olsson.com

Client Signature: _____

STORMWATER POLLUTION PREVENTION PLAN

Designed in accordance with the Missouri State Operating Permit

Cassville High School Performing Arts Center

Permit Tracking #

MORA 24217

Owner: Cassville R-IV School District

Cassville R-IV School District

1501 N. Main St.

Cassville, MO 65625

417.847.2221

Prepared by:

Olsson

550 E. St. Louis St.

Springfield, MO 65806

417.890.8802

March 2023

SWPPP Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

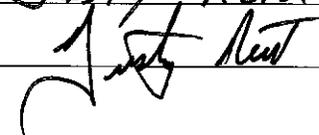
Name:

Dusty Reid

Title:

Director of Operations

Signature:



Date:

5/16/23

olsson

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Section 1	Delegation Statements & Contractor Certifications
Section 2.....	Permit Authorization & Missouri State Operating Permit
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Section 4.....	Location/Topographical Map(s), FIRM Maps, Soils Maps
Section 5.....	BMP Tracking Map & Land Disturbance Tracking Log
Section 6.....	BMP Specification and Detail Sheets
Section 7.....	Log of Amendments
Section 8.....	Local Regulations and Additional Permits
Section 9.....	Spill Response
Section 10.....	Endangered Species Documentation
Section 11.....	Historic Preservation Documentation
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Section 13.....	Regulatory Correspondence
Section 14.....	Notice of Termination

SECTION 1

Delegation Statements & Contractor Certifications

Delegation Statement(s) for applicable personnel should be kept in this section. Contractor Certification Statements that contain contact information for those responsible for specific activities on the project should also be kept here.

Delegation of Authority

I, Cassville R-IV School District, hereby designate the person(s) or specifically described position(s) below to be a duly authorized representative(s) for the purpose of overseeing compliance with environmental requirements, including the Missouri State Operating Permit.

Duly Authorized Representative:

Name or Position: Clint Walton

Company: RE Smith Construction Company

Address: 1036 W 2nd St, Joplin, MO 65801

Phone: 417-623-4545

Email: clint@resmithconst.com

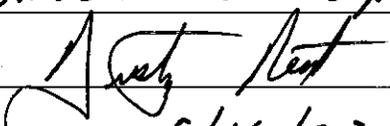
By signing the certification below, I certify that I meet the signing requirements VIII.11 of the Missouri State Operating Permit, 40 CFR 122.22 and 10 CSR 20-6.010 for this project.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Permittee Name: Dusty Reid

Company: Cassville R-IV School District

Title: Director of Operations

Signature: 

Date: 5/16/23

Contractor/Subcontractor Certification

Project Name: _____

Permit Number: _____

Project Owner: _____

As a contractor/subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review upon request.

Each contractor/subcontractor engaged in activities at the construction site that could impact stormwater should be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the SWPPP for the above designated project and agree to follow the practices described in the SWPPP.

This certification is hereby signed in reference to the project named above:

Service Provided: _____

Company Name: _____

Address: _____

Telephone: _____

Representative: _____

Title: _____

Signature: _____

Date: _____

Contractor/Subcontractor Certification

Project Name: _____

Permit Number: _____

Project Owner: _____

As a contractor/subcontractor, you are required to comply with the Stormwater Pollution Prevention Plan (SWPPP) for any work that you perform on-site. Any person or group who violates any condition of the SWPPP may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the SWPPP. A copy of the SWPPP is available for your review upon request.

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Service Provided: _____

Company Name: _____

Address: _____

Telephone: _____

Representative: _____

Title: _____

Signature: _____

Date: _____

SECTION 2

Permit Authorization & Missouri State Operating Permit

Permit authorization from the MDNR and a copy of the Missouri State Operating Permit will be kept in this section.

The Application for Land Disturbance Stormwater General Permit was completed through the Missouri Gateway for Environmental Management at <https://dnr.mo.gov/mogem/>.



Missouri Department of dnr.mo.gov

NATURAL RESOURCES

Michael L. Parson, Governor

Dru Buntin, Director

Cassville HS Performing Arts Center
MORA24217, Barry County
Cassville R-IV School District
1501 N. Main St.
Cassville, MO 65625

Pursuant to the Federal Water Pollution Control Act, under the authority granted to the State of Missouri and in compliance with the Missouri Clean Water Law, the Missouri Department of Natural Resources (Department) has issued, and we are enclosing your Missouri State Operating Permit which authorizes land disturbance activities for Cassville HS Performing Arts Center.

This General Permit is both your federal discharge permit and your new state operating permit and replaces all previous state operating permits and letters of approval for the discharges described within. In all future correspondence regarding this permit, please refer to your general permit number as shown on page one of your permit.

Please note that prior to the beginning of land disturbance activities other permits may also be required. Especially note the requirements for a Department 401 Water Quality Certification and the U.S. Army Corps of Engineers 404 permit. A 401 Certification is needed when placing material, or fill, into the jurisdictional waters of the United States. Examples are culverts under road crossings, riprap along stream banks and storm water outfall pipes. The term jurisdictional waters refers to large lakes, rivers, streams and wetlands, including those that don't always contain water.

This permit may include requirements with which you may not be familiar. If you would like the Missouri Department of Natural Resources (Department) to conduct a Compliance Assistance Visit to discuss the permit, an appointment can be set up by contacting your local Department Regional Office or the Water Pollution Program at 573-751-1300.

The permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). Refer to your permit for more information on this SWPPP.

The requirements found in this permit do not supersede nor relieve liability for compliance with other federal, state, county, or local statutes, regulations, or ordinances. Also, any exemptions found in this permit do not imply an exemption from other permits from the Department. It is your responsibility to ensure that any and all necessary permits for this facility have been obtained.

If you were adversely affected by this decision, you may be entitled to an appeal before the Administrative Hearing Commission (AHC) pursuant to Sections 644.051.6 and 621.250, RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is

received by the AHC. Contact information for the AHC is as follows: Administrative Hearing Commission, United States Post Office Bldg., Third Floor, 131 West High Street, Jefferson City, MO 65101, and PO Box 1557, Jefferson City, MO 65102. phone: 573 751 2422, fax: 573 751 5018, website: www.aa.mo.gov/ahc.

If you have any questions concerning this permit, please do not hesitate to contact us by mail at Department of Natural Resources, Water Protection Program, P.O. Box 176, Jefferson City, MO 65102-0176, or by phone at 573-522-4502. Thank you.

Sincerely,

Water Protection Program

A handwritten signature in black ink, appearing to read "John Hoke". The signature is written in a cursive style with a large initial "J".

John Hoke
Director

JH

Cassville HS Performing Arts Center
MORA24217

ePermitting Certification and Signature Document

Missouri State Operating General Permit number MORA24217 was issued on 05-17-2023 based on information entered into the Missouri Department of Natural Resources' electronic Permitting (ePermitting) system. Missouri Regulation 10 CSR 20-6.010(2)(B) requires that all applications for construction and operating permits be signed.

Cassville HS Performing Arts Center, Barry County
1825 State HWY Y
CASSVILLE, MO 65625
Total Permitted Area: 3.77 Acres
Total Number of Permitted Features: 1

Based upon the selection you made on the 'New Permit' screen; it was indicated that a single polygon was drawn indicating the entire disturbance area.

Is any part of the area that is being disturbed in a jurisdictional water of the United States? If yes, you must also receive a Clean Water Act, Section 404 Permit for this site from the United States Army Corp of Engineers.
No

Is any section of the area that is being disturbed part of a housing development (subdivision)? If yes, additional regulations may apply depending on the nature of wastewater treatment. Please consult and follow 10 CSR 20-6.030 Disposal of Wastewater in Residential Housing Development regulations if onsite wastewater treatment (septic) systems will be used as the method of wastewater treatment. If you have any questions or concerns about the regulation please contact the Water Pollution Control Branch, Operating Permits Section at 573-522-4502.
No

I understand there may be an established Local Authority Erosion Control Plan in the city or the unincorporated area of the county where land disturbance activities covered under this general permit will occur. (Note - you may want to contact your local authority to determine if there are any requirements).
Agreed

A Stormwater Pollution Prevention Plan (SWPPP) must be developed for this site. This plan must be developed in accordance with requirements and guidelines specified within the general permit for storm water discharges from land disturbance activities. The application will be considered incomplete if the SWPPP has not been developed.
Agreed

The above certifications were made electronically in the ePermitting system by:
Name: Springfield GNCV
Date: 05/16/2023

I certify that I am familiar with the information contained in the application, that to the best of my knowledge and belief such information is true, complete and accurate, and being granted this permit, I agree to abide by the Missouri Clean Water Law and all rules, regulations, orders and decisions, and terms of this permit, subject to any legitimate appeal available to an applicant under the Missouri Clean Water Commission.
Agreed

Dusty Reid
Signature

05-17-2023
Date

STATE OF MISSOURI
DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION



MISSOURI STATE OPERATING PERMIT

General Operating Permit

In compliance with the Missouri Clean Water Law, (chapter 644 R.S. Mo as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended,

Permit No.: MORA24217
Owner: Cassville R-IV School District
Address: 1501 N. Main St.
Cassville, MO 65625
Continuing Authority: Cassville R-IV School District
1501 N. Main St.
Cassville, MO 65625
Facility Name: Cassville HS Performing Arts Center
Facility Address: 1825 State HWY Y
CASSVILLE, MO 65625
Legal Description: Sec. 21, T 23N, R 27W, Barry County
UTM Coordinates: 422998.301 / 4060753.106
Receiving Stream: Tributary to Flat Cr. (U)
First Classified Stream - ID#: Flat Cr. (P) 2397.00
USGS# and Sub Watershed#: 11010002 - 0402

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein.

FACILITY DESCRIPTION

All Outfalls - Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling and other activities that result in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution to waters of the state).

This permit authorizes activities pursuant to the terms and conditions of this permit in accordance with the Missouri Clean Water Law and/or the National Pollutant Discharge Elimination System; it does not apply to other regulated activities.

05-17-2023

Issue date

02/07/2027

Expiration date

John Hoke, Director, Water Protection Program

I. APPLICABILITY

A. Permit Coverage and Authorized Discharges

1. This Missouri State Operating Permit (permit) authorizes the discharge of stormwater and certain non-stormwater discharges from land disturbance sites that disturb one or more acres, or disturb less than one acre when part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project. A permit must be issued before any disturbance of root zone of the existing vegetation or other land disturbance activities may begin.
2. If an individual or developer proposes to improve a lot for development or sale that is less than an acre and part of a common plan of development or sale, a permit is required. If an individual proposes to develop a lot to reside on themselves, the development is not considered part of the larger common plan of development or sale and does not require a permit unless the lot is an acre or more [10 CSR 20-6.200 (1)(B)6.]. See table below.

Permit Requirements for a Common Promotional Plan

	Land Disturbance Permit Required?	
	Less than one acre (< 1 acre)	One acre or more (\geq 1 acre)
Land disturbance by a developer (or a contractor working on their behalf), regardless of type of development (initial, commercial, residential)	Yes, if part of a larger common plan of development or sale with cumulative disturbance of one or more acres including individual residential lots in order to improve the lot for sale	Yes
Land disturbance by an individual to reside on themselves (or a contractor working on their behalf)	No	Yes

This general permit also authorizes the discharge of stormwater and certain non-stormwater discharges from smaller projects where the Missouri Department of Natural Resources (Department) has exercised its discretion to require a permit [10 CSR 20-6.200 (1)(B)].

A Missouri State Operating Permit (MORA, MOR100, or site specific) that specifically identifies the project must be issued before any site vegetation is removed (disturbance of the root zone) or the site disturbed [10 CSR 20-6.200 (1)(A)].

Any persons who operate, use, or maintain a land disturbance activity (owner/operator) which is subject to permitting requirements for stormwater discharges from land disturbance activities, who disturbs land prior to permit issuance from the Department is in violation of both State [10 CSR 20-6.200 (1)(A)] and Federal regulations.

The owner/operator and continuing authority of this permit are responsible for compliance with this permit [10 CSR 20-6.200 (3)(B)].

The primary operator(s) of a land disturbance site is any party associated with the project who either: 1) has operational control over construction plans, including the ability to make modifications to those plans; or 2) has day-to-day operational control of those activities at a project that are necessary to ensure compliance with the permit conditions. This may be the General Contractor, Project Manager, or similar role.

3. This permit authorizes stormwater discharges from land disturbance support activities (e.g., equipment staging yards, material storage areas, excavated material disposal areas, borrow areas, concrete, or asphalt batch plants) provided appropriate stormwater controls are designed, installed, and maintained and the following conditions are met and addressed in the Stormwater Pollution Prevention Plan (SWPPP):
 - (a) The support activity is directly related to the construction site required to have permit coverage for stormwater discharges;
 - (b) The support activity is not a commercial operation or serve multiple unrelated construction sites;
 - (c) The support activity does not continue to operate beyond the completion of the construction activity at the project it supports;
 - (d) Sediment and erosion controls are implemented in accordance with the conditions of this permit; and
 - (e) The support activity is strictly stormwater discharges. Support activities which discharge process water shall apply for separate coverage, such as a concrete batch plant discharging process water shall be covered under a MOG49.

The permittee is responsible for compliance with this permit for any construction support activity.

4. This permit authorizes non-stormwater discharges from the following activities provided that these discharges are treated by appropriate Best Management Practices (BMPs) where applicable and addressed in the permittee's specific SWPPP required by this general permit:
 - (a) Discharges from emergency fire-fighting activities;
 - (b) De-chlorinated fire hydrant flushing;
 - (c) Uncontaminated water line flushing;
 - (d) Uncontaminated condensate from air conditioning or compressor condensate;
 - (e) Landscape watering;
 - (f) Uncontaminated, non-turbid discharges of ground water or spring water;
 - (g) Foundation or footing drains where flows are not contaminated with process materials;
 - (h) Water used to control dust; and
 - (i) Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. Directing pavement wash waters directly into any water of the state, storm inlet, or stormwater conveyance, unless the conveyance is connected to an effective control, is prohibited.
5. Sites that have contaminated soils that will be disturbed by the land disturbance activity, or where such materials are brought to the site to use as fill or borrow, shall notify the Department's Water Protection Program for approval before applying for coverage under this permit. The Department reserves the right to revoke or deny coverage under this general permit; a site-specific permit may be required to cover such activities.

B. Permit Restrictions

1. Any non-stormwater discharges other than those explicitly authorized in Part I APPLICABILITY, Condition A.3 are prohibited under this permit.
2. This permit does not authorize the discharge of process wastewaters, treated or otherwise, including water used to wash machinery, equipment, buildings, or wastewater from washout of concrete.
3. For sites operating within the watershed of any Outstanding National Resource Water (which includes the Ozark National Riverways and the National Wild and Scenic Rivers System), sites that discharge to an Outstanding State Resource Water, or facilities located within the watershed of an impaired water as designated in the 305(b) report, including the 303(d) list, with an impairment for sediment:
 - (a) This permit authorizes stormwater discharge so long as no degradation of water quality occurs due to discharges from the permitted facility per 10 CSR 20-7.031(3)(C) and as long as the facility is 1,000 or more feet away from the Outstanding National or State Resource Water or a water of the state with an impairment for sediment.
 - (b) A site with a discharge found to be causing degradation or contributing to an impairment by discharging a pollutant of concern, during an inspection or through complaint investigations, may be required to become a no discharge facility or obtain a site-specific permit with more stringent monitoring and SWPPP requirements.
 - (c) For sites within 1,000 feet of Outstanding National or State Resource Water or a water of the state with an impairment for sediment, the site shall operate as a no-discharge facility as defined in 10 CSR 20-6.015(1)(B)7, and discharges from dewatering of sedimentation basins is prohibited.
4. This general permit does not authorize the placement of fill materials in flood plains, placement of fill into any floodway, the obstruction of stream flow, or changing the channel of a defined drainage course. This general permit addresses only the quality of the stormwater runoff and the minimization of off-site migration of sediments and other water contaminants.
5. This permit does not allow stream channel or wetland alterations unless approved by Section 404 of the federal Clean Water Act (CWA) permitting authorities. Land disturbance activities may not begin in waters of the United States until any required Section 404 permit and Section 401 certification have been obtained.
6. This operating permit does not affect, remove, or replace any requirement of the National Environmental Policy Act; the Endangered Species Act; the National Historic Preservation Act; the Comprehensive Environmental Response, Compensation and Liability Act; the Resource Conservation and Recovery Act; or any other relevant acts. Determination of applicability to the above mentioned acts is the responsibility of the permittee. Additionally, this permit does not establish terms and conditions for runoff resulting from silvicultural activities listed in Section 402(l)(3)(a) of the Clean Water Act.
7. Compliance with all requirements in this permit does not supersede any requirement for obtaining project approval from an established local authority nor remove liability for compliance with county and other local ordinances.

8. The Department may require any facility or site authorized by a general permit to apply for a site-specific permit [10 CSR 20-6.010(13)(C)]. Cases where a site-specific permit may be required include, but are not limited to, the following:
 - (a) The discharge(s) is a significant contributor of a pollutant(s) which impairs the designated uses or general criteria of the receiving stream;
 - (b) The discharger is not in compliance with the conditions of the general permit;
 - (c) A Total Maximum Daily Load (TMDL) containing requirements applicable to the discharge(s) is approved; or
 - (d) Materials or contaminants exist at the site, or are brought to the site to use as fill or borrow, which may necessitate special controls or permit limits not otherwise considered under this general permit, such as contaminated soils from federal clean-up sites. This general permit may be authorized when additional contaminant controls are proposed by the applicant and the proposal is accepted by the Department in written correspondence.
9. If a facility or site covered under a current general permit desires to apply for a site-specific permit, the facility or site may do so by contacting the Department for application requirements and procedures.
10. Any discharges not expressly authorized in this permit and not clearly disclosed in the permit application cannot become authorized or shielded from liability under CWA section 402(k) or Section 644.051.16, RSMo, by disclosure to EPA, state, or local authorities after issuance of this permit via any means, including any other permit applications, funding applications, the SWPPP, discharge monitoring reporting, or during an inspection. Discharges at the facility not expressly authorized by this permit must be covered by another permit, be exempt from permitting, or be authorized through some other method.
11. In the event that a State of Emergency is declared, either by the State or Federal government, and as a result an emergency-related project requires land disturbance activity that requires a permit, the owner/operator of the project may begin work prior to permit issuance so long as they implement sediment and erosion controls in compliance with the master general permit conditions contained herein. The owner/operator is not exempt from permitting and shall apply for the land disturbance permit as soon as practicable but no later than seven calendar days after starting work. The Department may determine that other emergencies, considered on a case-by-case basis, are applicable. Contact the Department to determine if non-state of emergencies are applicable.

II. EXEMPTIONS FROM PERMIT REQUIREMENTS

1. Facilities that discharge all stormwater runoff directly to a combined sewer system (as defined in 40 CFR 122.26 and 40 CFR 35.2005) connecting to a publicly owned treatment works which has consented to receive such a discharge are exempt from Department stormwater permit requirements.
2. Land disturbance activities that disturb less than one (1) acre of total land area which are not part of a common plan of sale where water quality standards are not exceeded are exempt from Department stormwater permit requirements. Land disturbance activity on an individual residential building lot is not considered as part of the overall subdivision unless the activity is by the developer to improve the lot for sale.
3. Oil and gas related activities as listed in 40 CFR 122.26(a)(2)(ii) where water quality standards are not exceeded are exempt from Department stormwater permit requirements.
4. Linear, strip, or ribbon construction or maintenance operations meeting one (1) of the following criteria are exempt from Department stormwater permit requirements:
 - (a) Grading of existing dirt or gravel roads which does not increase the runoff coefficient and the addition of an impermeable surface over an existing dirt or gravel road;
 - (b) Cleaning or routine maintenance of roadside ditches, sewers, waterlines, pipelines, utility lines, or similar facilities;
 - (c) Trenches two (2) feet in width or less; or
 - (d) Emergency repair or replacement of existing facilities as long as BMPs are employed during the emergency repair.

III. REQUIREMENTS

1. The permittee shall post a public notification sign at the main entrance to the site with the specific MORA permit number. The public notification sign must be visible from the public road that provides access to the site's main entrance. An alternate location is acceptable provided the public can see it and it is noted in the SWPPP. The public notification sign must remain posted at the site until the permit has been terminated. The sign is provided at the end of this permit.

2. The permittee shall be responsible for notifying the land owner and each contractor or entity (including utility crews and city employees or their agents) who will perform work at the site of the existence of the SWPPP and what actions or precautions shall be taken while on-site to minimize the potential for erosion and the potential for damaging any BMP. The permittee is responsible for any damage a subcontractor may do to established BMPs and any subsequent water quality violation resulting from the damage.
3. Ensure the design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed, and maintained to:
 - (a) Control stormwater volume, velocity, and peak flow rates within the site to minimize soil erosion;
 - (b) Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion and scour;
 - (c) Minimize the amount of exposed soil during construction activity;
 - (d) Minimize the disturbance of steep slopes;
 - (e) Minimize sediment discharges from the site. Address factors such as:
 - 1) the amount, frequency, intensity, and duration of precipitation;
 - 2) the nature of resulting stormwater runoff;
 - 3) expected flow from impervious surfaces, slopes, and drainage features; and
 - 4) soil characteristics, including the range of soil particle size expected to be present on the site;
 - (f) Provide and maintain natural buffers around surface waters as detailed in Part V. BMP REQUIREMENTS Condition 7, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration and filtering, unless infeasible;
 - (g) Minimize soil compaction and preserve topsoil where practicable; and
 - (h) Capture or treat a 2-year, 24-hour storm event.
4. A 2-year, 24-hour storm event shall be determined for the project location using the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 which can be located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html.
 - (a) As an alternative to utilizing NOAA Atlas 14 for site specific data to determine the 2-year, 24-hour storm event the conservative default value can be used based on the map provided by the Department in the Factsheet portion of this permit. The permittee may choose which source to use for the site specific data.
5. BMPs for land disturbance [10 CSR 20-6.200(1)(D)2] are a schedule of activities, practices, or procedures that reduces the amount of soil available for transport or a device that reduces the amount of suspended solids in runoff before discharge to waters of the state. The term BMPs are also used to describe the sediment and erosion controls and other activities used to prevent stormwater pollution. BMPs are divided into two main categories: structural or non-structural; and they are also classified as temporary or permanent.
6. Installation of BMPs necessary to prevent soil erosion and sedimentation at the downgradient project boundary (e.g. buffers, perimeter controls, exit point controls, storm drain inlet protection) must be complete prior to the start of all phases of construction. By the time construction activity in any given portion of the site begins, downgradient BMPs must be installed and operational to control discharges from the initial site clearing, grading, excavating, and other earth-disturbing activities. Additional BMPs shall be installed as necessary throughout the life of the project. Following the installation of these initial BMPs, all BMPs needed to control discharges shall be installed and made operational prior to subsequent earth disturbing activities.
7. Temporary BMPs may be added and removed as necessary with updates to the SWPPP as specified in the requirements below.
8. All BMPs shall be maintained and remain in effective operating condition during the entire duration of the project, with repairs made within the timeframes specified elsewhere in this permit, until final stabilization has been achieved.
 - (a) Ensure BMPs are protected from activities that would reduce their effectiveness.
 - (b) Remove any sediment per the BMP manufacturer's instructions or before it has accumulated to one-half of the above-ground height of any BMP that collects sediment (i.e. silt fences, sediment traps, etc.)
 - (c) The project is considered to achieve final stabilization when Part V. BMP REQUIREMENTS, Condition 13 is met.
9. Minimize sediment trackout from the site and sediment transport onto roadways.
 - (a) Restrict vehicle traffic to designated exit points.
 - (b) Use appropriate stabilization techniques or BMPs at all points that exit onto paved roads or areas outside of the site.
 - (c) Use additional controls to remove sediment from vehicle and equipment tires prior to exit from facility where necessary.
 - (d) Any sediment or debris that is tracked out past the exit pad or is deposited on a roadway after a precipitation event shall be removed the shorter of either daily or before a rain event. Remove the track-out sediment by sweeping, shoveling, or vacuuming these surfaces, or by using other similarly effective means of sediment removal. Sediment or debris tracked out

on pavement or other impervious surfaces shall not be disposed of into any stormwater conveyance, storm drain inlet, or water of the state.

- (e) Stormwater inlets susceptible to receiving sediment or other pollutants from the permitted land disturbance site shall have curb inlet protection. This may include inlets off the active area where track out from vehicles and equipment could impact the stormwater runoff to those inlets.
10. Concrete washout facilities shall be used to contain concrete waste from the activities onsite, unless the washout of trucks and equipment is managed properly at an offsite location.
The washout facility shall be managed to prevent solid and/or liquid waste from entering waters of the state by the following:
 - (a) Direct the wash water into leak-proof containers or pits designed so that no overflows can occur due to inadequate sizing or precipitation;
 - (b) Locate washout activities a minimum of 50 feet from waters of the state, stormwater inlets and/or stormwater conveyances;
 - (c) Washout facilities shall be cleaned, or new facilities must be constructed and ready for use, once the washout is 75% full;
 - (d) Designate the washout area(s) and conduct such activities only in these areas.
 - (e) Ensure contractors are aware of the location, such as by marking the area(s) on the map or signage visible to the truck and/or equipment operators.
 11. Good housekeeping practices shall be maintained at all times to keep waste from entering waters of the state.
 - (a) Provide solid and hazardous waste management practices, including providing trash containers, regular site cleanup for proper disposal of solid waste such as scrap building material, product/material shipping waste, food/beverage containers, spent structural BMPs;
 - (b) Provide containers and methods for proper disposal of waste paints, solvents, and cleaning compounds.
 - (c) Manage sanitary waste. Portable toilets shall be positioned so that they are secure and will not be tipped or knocked over and so that they are located away from waters of the state and stormwater inlets and stormwater conveyances.
 - (d) Ensure the storage of construction materials be kept away from drainage courses, stormwater conveyances, storm drain inlets, and low areas.
 12. All fueling facilities present shall at all times adhere to applicable federal and state regulations concerning underground storage, above ground storage, and dispensers.
 13. Any hazardous wastes that are generated onsite shall be managed, stored, and transported according to the provisions of the Missouri Hazardous Waste Laws and Regulations.
 14. Store all paints, solvents, petroleum products, petroleum waste products, and storage containers (such as drums, cans, or cartons) so they are not exposed to stormwater or provide other prescribed BMPs such as plastic lids and/or portable spill pans to prevent the commingling of stormwater with container contents. Commingled water may not be discharged under this permit. Provide spill prevention, control, and countermeasures to contain the spill. Any containment system used to implement this requirement shall be constructed of materials compatible with the substances contained and shall prevent the contamination of groundwater.
 15. Implement measures intended to prevent the spillage or loss of fluids, oil, grease, fuel, etc. from vehicles and equipment to thereby prevent the contamination of stormwater from these substances. This may include prevention measures such as, but not limited to, utilizing drip pans under vehicles and equipment stored outdoors, covering fueling areas, using dry clean-up methods, use of absorbents, and cleaning pavement surfaces to remove oil and grease.
 16. Spills, Overflows, and Other Unauthorized Discharges.
 - (a) Any spill, overflow, or other discharge not specifically authorized in the permit above are unauthorized.
 - (b) Should an unauthorized discharge cause or permit any contaminants to discharge or enter waters of the state, the unauthorized discharge must be reported to the appropriate Regional Office as soon as practicable but no more than 24 hours after the discovery of the discharge. If the spill or overflow needs to be reported after normal business hours or on the weekend, the facility must call the Department's Environmental Emergency Response hotline at (573) 634-2436. Leaving a message on a Department staff member voice-mail does not satisfy this reporting requirement.
 - (c) A record of all spills shall be retained with the SWPPP and made available to the Department upon request.
 - (d) Other spills not reaching waters of the state must be cleaned up as soon as possible to prevent entrainment in stormwater but are not required to be reported to the Department.
 17. The full implementation of this operating permit shall constitute compliance with all applicable federal and state statutes and regulations in accordance with RSMo 644.051.16 and the CWA §402(k); however, this permit may be reopened and modified or alternatively revoked and reissued to comply with any applicable effluent standard or limitation issued or approved under Clean Water Act §§ 301(b)(2)(C) and (D), 304(b)(2), and 307(a)(2) if the effluent standard or limitation so issued or approved contains different conditions or is otherwise more stringent than any effluent limitation in the permit or controls any pollutant not limited

in the permit. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit modification, termination, notice of planned changes, or anticipated non-compliance does not stay any permit condition.

IV. STORMWATER POLLUTION PREVENTION PLAN (SWPPP) MANAGEMENT REQUIREMENTS

1. The primary requirement of this permit is the development and implementation of a SWPPP which incorporates site specific practices to best minimize the soil exposure, soil erosion, and the discharge of pollutants, including solids.

The purpose of the SWPPP is to ensure the design, implementation, management, and maintenance of BMPs in order to prevent sediment and other pollutants in stormwater discharges associated with the land disturbance activities [40 CFR 122.44 (k)(4)] from entering waters of the state above established general and narrative criteria; compliance with Missouri Water Quality Standards; and compliance with the terms and conditions of this general permit.

- (a) **The SWPPP must be developed and implemented prior to conducting any land disturbance activities and must be specific to the land disturbance activities at the site.**
 - (b) The permittee shall fully implement the provisions of the SWPPP required under this permit as a condition of this general permit throughout the term of the land disturbance project. Failure to develop, implement, and maintain a SWPPP may lead to immediate enforcement action.
 - (c) The SWPPP is a living document and shall be updated any time site conditions warrant adjustments to the project or BMPs.
 - (d) Either an electronic copy or a paper copy of the SWPPP, and any required reports, must be accessible to anyone on-site at all times when land disturbance operations are in process or other operational activities that may affect the maintenance or integrity of the BMP structures and made available as specified under Part VIII. STANDARD PERMIT CONDITIONS, Condition 1 of this permit. The SWPPP shall be readily available upon request and should not be sent to the Department unless specifically requested
2. A SWPPP must be developed, implemented, and maintained at the site or electronically accessible by on-site personnel. Failure to implement and maintain the BMPs chosen, which can be revised and updated, is a permit violation. The chosen BMPs will be the most reasonable and cost effective while also ensuring the highest quality water discharged attainable for the facility. Facilities with established SWPPPs and BMPs shall evaluate BMPs on a regular basis and change the BMPs as needed if there are BMP deficiencies.
 3. The SWPPP must:
 - (a) List and describe the location of all outfalls;
 - (b) List any allowable non-stormwater discharges occurring on site and where these discharges occur;
 - (c) Incorporate required practices identified below;
 - (d) Incorporate sediment and erosion control practices specific to site conditions;
 - (e) Discuss whether or not a 404 Permit is required for the project;
 - (f) Discuss whether the discharges are in the watershed of Outstanding National or State Resource Water or in the watershed of a water impaired for sediment.
 - (g) Name the person(s) responsible for inspection, operation, and maintenance of BMPs. The SWPPP shall list the names and describe the role of all owners/primary operators (such as general contractor, project manager) responsible for environmental or sediment and erosion control at the land disturbance site.
 4. The SWPPP briefly must describe the nature of the land disturbance activity, including:
 - (a) The function of the project (e.g., low density residential, shopping mall, highway, etc.);
 - (b) The intended sequence and timing of activities that disturb the soils at the site;
 - (c) Estimates of the total area expected to be disturbed by excavation, grading, or other land disturbance support activities including off-site borrow and fill areas;
 - (d) If within the boundaries of a regulated Municipal Separate Storm Sewer System (MS4s), list the name of the regulated MS4.
 5. In order to identify the site, the SWPPP shall include site information including size in acres. The SWPPP shall have sufficient information to be of practical use to contractors and site construction workers to guide the installation and maintenance of BMPs.
 6. The function of the SWPPP and the BMPs listed therein is to prevent or minimize pollution to waters of the state. A deficiency of a BMP means it was not effective in preventing or minimizing pollution of waters of the state.

The permittee shall select, install, use, operate and maintain appropriate BMPs for the permitted site. The following manuals are acceptable resources for the selection of appropriate BMPs:

Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, (Document number EPA 833-R-06-004) published by the United States Environmental Protection Agency (USEPA) in May 2007. This manual as well as other

information, including examples of construction SWPPPs, is available at the USEPA internet site at https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf; and <https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp>.

The latest version of *Protecting Water Quality: A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri*, published by the Department. This manual is available at: <https://dnr.mo.gov/document-search/protecting-water-quality-field-guide>.

The permittee is not limited to the use of these guidance manuals. Other guidance publications may be used to select appropriate BMPs. However, all BMPs must be described and justified in the SWPPP. Although the use of these manuals or other resources is recommended and may be used for BMP selection, they do not supersede the conditions of this permit. They may be used to inform in the decision making process for BMP selection but they are not themselves part of the permit conditions.

The permittee may retain the SWPPP, inspection reports, and all other associated documents (including a copy of this permit) electronically pursuant to RSMo 432.255. The documents must be made available to all interested persons in either paper or electronic format as required by this permit and the permittee must remit a copy (electronic or otherwise) of the SWPPP and inspection reports to the Department upon request.

7. The SWPPP must contain a legible site map, multiple maps if necessary, identifying:
 - (a) Site boundaries of the property;
 - (b) Locations of all waters of the state (including wetlands) within the site and half a mile downstream of the site's outfalls;
 - (c) Location of all outfalls;
 - (d) Direction(s) of stormwater flow (use arrows) and approximate slopes before and after grading activities;
 - (e) Areas of soil disturbance and areas that will not be disturbed (or a statement that all areas of the site will be disturbed unless otherwise noted);
 - (f) Location of structural and non-structural BMPs, including natural buffer areas, identified in the SWPPP;
 - (g) Locations where stabilization practices are expected to occur;
 - (h) Locations of on-site and off-site material, waste, borrow or equipment storage areas and stockpiles;
 - (i) Designated points where vehicles will exit the site;
 - (j) Location of stormwater inlets and conveyances including ditches, pipes, man-made conduits, and swales; and
 - (k) Areas where final stabilization has been achieved.
8. An individual shall be designated by the permittee as the environmental lead. This environmental lead shall have knowledge in erosion, sediment, and stormwater control principles, knowledge of the permit, and the site's SWPPP. The environmental lead shall ensure all personnel and contractors understand any requirements of this permit may be affected by the work they are doing. The environmental lead or designated inspector(s) knowledgeable in erosion, sediment, and stormwater control principles shall inspect all structures that function to prevent or minimize pollution of waters of the state.
9. Throughout coverage under this permit, the permittee shall amend and update the SWPPP as appropriate during the term of the land disturbance activity. All SWPPP modifications shall be signed and dated. The permittee shall amend the SWPPP to incorporate any significant site condition changes which impact the nature and condition of stormwater discharges. At a minimum, these changes include whenever the:
 - (a) Location, design, operation, or maintenance of BMPs is changed;
 - (b) Design of the construction project is changed that could significantly affect the quality of the stormwater discharges;
 - (c) Permittee's inspections indicate deficiencies in the SWPPP or any BMP;
 - (d) Department notifies the permittee in writing of deficiencies in the SWPPP;
 - (e) SWPPP is determined to be ineffective in minimizing or controlling erosion and sedimentation (e.g., there is visual evidence of excessive site erosion or sediment deposits in streams, lakes, or downstream waterways, sediment or other wastes offsite); and/or
 - (f) Department determines violations of water quality standards may occur or have occurred.
10. Site Inspections: The environmental lead, or a designated inspector, shall conduct regularly scheduled inspections. These inspections shall be conducted by a qualified person, one who is responsible for environmental matters at the site, or a person trained by and directly supervised by the person responsible for environmental matters at the site. Site inspections shall include, at a minimum, the following:
 - (a) For disturbed areas that have not achieved final stabilization, all installed BMPs and other pollution control measures shall be inspected to ensure they are properly installed, appear to be operational, and are working as intended to minimize the discharge of pollutants.
 - (b) For areas on site that have achieved either temporary or final stabilization, while at the same time active construction continues on other areas, ensure that all stabilization measures are properly installed, appear to be operational, and are

- working as intended to minimize the discharge of pollutants.
- (c) Inspect all material, waste, borrow, and equipment storage, and maintenance areas that are covered by this permit. Inspect for conditions that could lead to spills, leaks, or other accumulations of pollutants on the site.
 - (d) Inspect all areas where stormwater typically flows within the site, including drainage ways designed to divert, convey, and/or treat stormwater.
 - (e) All stormwater outfalls shall be inspected for evidence of erosion, sediment deposition, or impacts to the receiving stream. If a discharge is occurring during an inspection, the inspector must observe and document the visual quality of the discharge, and take note of the characteristics of the stormwater discharge, including turbidity, color; odor; floating, settled, or suspended solids; foam; oil sheen; and other indicators of stormwater pollutants.
 - (f) When practicable the receiving stream shall also be inspected for a minimum of 50 feet downstream of the outfall.
 - (g) The perimeter of the site shall be inspected for evidence of BMP failure to ensure concentrated flow does not develop a new outfall.
 - (h) The SWPPP must explain how the environmental lead will be notified when stormwater runoff occurs.

11. Inspection Frequency: All BMPs must be inspected in accordance to one of the schedules listed below. The inspection frequency shall be documented in the SWPPP, and any changes to the frequency of inspections, including switching between the options listed below, must be documented on the inspection form:
- (a) At least once every seven (7) calendar days and within 48 hours after any storm event equal to or greater than a 2-year, 24-hour storm has ceased during a normal work day or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday; or
 - (b) Once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches of precipitation or greater, or the occurrence of runoff from snowmelt. To determine if a storm event of 0.25 inches or greater has occurred on the site, the permittee shall either keep a properly maintained rain gauge on site, or obtain the storm event information from a weather station near the site location.
 - 1) Inspections are only required during the project's normal working hours.
 - 2) An inspection must be conducted within 24 hours of a storm event which has produced 0.25 inches. The inspection shall be conducted within 24 hours of the event end, or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
 - 3) If it is elected to inspect every 14 calendar days and there is a storm event at the site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, the permittee shall conduct an inspection within 24 hours of the end of the storm or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.
 - (c) For any portion of the site that discharges within the watershed of an Outstanding National or State Resource Water or a water impaired for sediment, inspections shall be inspected once every seven (7) calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater, or when the occurrence of runoff flow from frozen or snowmelt is sufficient to cause a discharge.
 - (d) Areas on-site that have achieved stabilization, while at the same time active construction continues on other areas, may reduce inspection frequency to monthly, for those stabilized areas, if the following conditions exist:
 - 1) For areas where disturbed portions have undergone temporary stabilization, inspections shall occur at least once a month while stabilized and when re-disturbed shall follow either frequency outlined in (a),(b), or (c) above.
 - 2) Areas on-site that have achieved final stabilization must be inspected at least once per month until the permit is terminated.
 - (e) If construction activities are suspended due to frozen conditions, the permittee may temporarily reduce site inspections to monthly until thawing conditions begin to occur if all of the following are met:
 - 1) Land disturbances have been suspended; and
 - 2) All disturbed areas of the site have been stabilized in accordance with Part V. BMP REQUIREMENTS, Condition 13.
 - 3) The change shall be noted in the SWPPP.
 - (f) Any basin dewatering shall be inspected daily when discharge is occurring. The discharge shall be observed and dewatering activities shall be ceased immediately if the receiving stream is being impacted. These inspections shall be noted on a log or on the inspection report.

If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (including pictures) and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The documentation must be filed with the regular inspection reports. The corrections shall be made as soon as weather conditions or other issues allow.

12. Site Inspection Reports: A log of each inspection and/or copy of the inspection report shall be kept readily accessible and must be made available upon request by the Department. Electronic logs are acceptable as long as reports can be provided within 24 hours. If inspection reports are kept off-site, the SWPPP must indicate where they are stored. The inspection report shall be signed by the environmental lead or designated inspector (electronically or otherwise).
- (a) The inspection report is to include the following minimum information:

- 1) Inspector's name and title.
 - 2) Date and time of inspection.
 - 3) Observations relative to the effectiveness of the BMPs and stabilization measures. The following must be documented:
 - a. Whether BMPs are installed, operational, and working as intended;
 - b. Whether any new or modified stormwater controls are needed;
 - c. Facilities examined for conditions that could lead to spill or leak;
 - d. Outfalls examined for visual signs of erosion or sedimentation at outfalls. Excessive erosion or sedimentation may be due to BMP failure or insufficiency. Response to observations should be addressed in the inspection report.
 - 4) Corrective actions taken or necessary to correct the observed problem.
 - 5) Listing of areas where land disturbance operations have permanently or temporarily stopped.
13. Any structural or maintenance deficiencies for BMPs or stabilization measures shall be documented and corrected as soon as possible but no more than seven (7) calendar days after the inspection.
- (a) Corrective action documentation shall be stored with the associated site inspection report.
 - (b) Immediately take all reasonable steps to address the condition, including cleaning up any contaminated surfaces so the material will not discharge in subsequent storm events.
 - (c) If weather conditions or other issues prevent correction of BMPs within seven calendar days, the reasons for the delay must be documented (this may include pictures) and there must be a narrative explaining why the work cannot be accomplished within the seven day time period. The permittee shall correct the problem as soon as weather conditions or issues allow.
 - (d) Corrective actions may be required by the Department. The permittee must comply with any corrective actions required by the Department as a result of permit violations found during an inspection.

V. BMP REQUIREMENTS

1. The information, practices, and BMP requirements in this section shall be implemented on site and, where noted, provided for in the SWPPP.
2. Existing vegetation and trees shall be preserved where practicable. The permittee is encouraged to preserve topsoil where practicable. Trees designated for preservation should have a protective barrier outside of the dripline, or the area directly located under the outer reaches of the tree's branches.
3. The permittee shall select appropriate BMPs for use at the site and list them in the SWPPP. When selecting effective BMPs, the permittee shall consider stormwater volume and velocity and shall incorporate more than one BMP and sequential treatment devices where the use of a single BMP is ineffective to prevent or minimize sediment or other pollutants from leaving the site. Permittee should consider a schedule for performing erosion control measures when selecting BMPs.
4. The SWPPP shall include a description of both structural and non-structural BMPs that will be used at the site.
 - (a) The SWPPP shall provide the following general information for each BMP which will be used one or more times at the site:
 - 1) Physical description of the BMP;
 - 2) Site conditions that must be met for effective use of the BMP;
 - 3) BMP installation/construction procedures, including typical drawings; and
 - 4) Operation and maintenance procedures and schedules for the BMP.
 - (b) The SWPPP shall provide the following information for each specific instance where a BMP is to be installed:
 - 1) Whether the BMP is temporary or permanent;
 - 2) When the BMP will be installed in relation to each phase of the land disturbance procedures to complete the project; and
 - 3) Site conditions that must be met before removal of the BMP if the BMP is not a permanent BMP.
5. Structural BMP Installation: The permittee shall ensure all BMPs are properly installed and operational at the locations and relative times specified in the SWPPP.
 - (a) Perimeter control BMPs for runoff from disturbed areas shall be installed or existing vegetative areas marked for preservation before general site clearing is started. Note this requirement does not apply to earth disturbances related to initial site clearing and establishing entry, exit, or access of the site, which may require that stormwater controls be installed immediately after the earth disturbance.
 - (b) For phased projects, BMPs shall be properly installed as necessary prior to construction activities.
 - (c) Stormwater discharges which leave the site from disturbed areas shall pass through an appropriate impediment to sediment movement such as a sedimentation basin, sediment traps (including vegetative buffers), or silt fences prior to leaving the land disturbance site.
 - (d) A drainage course change shall be clearly marked on a site map and described in the SWPPP.
 - (e) If vegetative stabilization measures are being implemented, stabilization efforts are considered "installed" when all activities

necessary to seed or plant the area are completed. Vegetative stabilization is not considered “operational” until the vegetation is established.

6. Install sediment controls along any perimeter areas of the site that are downgradient from any exposed soil or other disturbed areas. Prevent stormwater from circumventing the edge of the perimeter control. For sites where perimeter controls are infeasible, other practices shall be implemented to minimize discharges to perimeter areas of the site.
7. For surface waters of the state, defined in Section 644.016.1(27) RSMo, located on or adjacent to the site, the permittee must maintain a riparian buffer or structural equivalent in accordance with at least one of the following options. The selection and location must be described in the SWPPP.
 - (a) Provide and maintain a 50-foot undisturbed natural buffer; or
 - (b) Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or
 - (c) If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.
 - (d) The permittee is not required to comply with (a), (b), or (c) above if one or more of the following exceptions apply and documentation is provided in the SWPPP:
 - 1) If there is no discharge of stormwater to waters of the state through the area between the disturbed portions of the site and waters of the state located within 50 feet of the site. This includes situations where the permittee has implemented permanent control measures that will prevent such discharges, such as a berm or other barrier.
 - 2) Where no natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for the current development of the site.
 - a. Where some natural buffer exists but portions of the area within 50 feet of the waters of the state are occupied by preexisting development disturbances the permittee is required to comply with (a), (b), or (c) above.
 - 3) For linear projects where site constraints make it infeasible to implement a buffer or equivalent provided the permittee limit disturbances within 50 feet of any waters of the state and/or the permittee provides supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the water of the state. The permittee must also document in the SWPPP the rationale for why it is infeasible for the permittee to implement (a), (b), or (c) and describe any buffer width retained and supplemental BMPs installed.
 - (e) Where the permittee is retaining a buffer of any size, the buffer should be measured perpendicularly from any of the following points, whichever is further landward from the water:
 - 1) The ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or
 - 2) The edge of the stream or river bank, bluff, or cliff, whichever is applicable.
8. Slopes for disturbed areas must be identified in the SWPPP. A site map or maps defining the sloped areas for all phases of the project must be included in the SWPPP. The disturbance of steep slopes shall be minimized.
9. Manage stockpiles or land clearing debris piles composed, in whole or in part, of sediment and/or soil.
 - (a) Locate the piles outside of any natural buffers zones, established under the condition above, and away from any stormwater conveyances, drain inlets, and areas where stormwater flow is concentrated;
 - (b) Install a sediment barrier along all downgradient perimeter areas;
 - (c) Prevent stormwater flows from causing erosion of stockpiles, for example, by diverting flows around them.
 - (d) For piles that will be unused for 14 or more days, provide cover with appropriate temporary stabilization in accordance with Part V. BMP REQUIREMENTS, Condition 13.
 - (e) Rinsing, sweeping, or otherwise placing any soil, sediment, debris, or stockpiled product which has accumulated on pavement or other impervious surfaces into any stormwater conveyance, storm drain inlet, or water of the state is prohibited.
10. The site shall include BMPs for pollution prevention measures and shall be noted in the SWPPP. At minimum such measures must be designed, installed, implemented, and maintained to:
 - (a) Minimize the discharge of pollutants from equipment and vehicle rinsing; no detergents, additives, or soaps of any kind shall be used. Rinse waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
 - (b) Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste, and other materials present on the site to precipitation and to stormwater;
 - (c) Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures, including, but not limited to, the installation of containment berms and use of drip pans at petroleum product and liquid storage tanks and containers; and
 - (d) Prevent discharges from causing or contributing to an exceedance of water quality standards including general criteria.

11. Sedimentation Basins: The SWPPP shall include a sedimentation basin for each drainage area with ten or more acres disturbed at one time.
 - (a) The sedimentation basin shall be sized, at a minimum, to treat a local 2-year, 24-hour storm.
 - (b) Sediment basins shall not be constructed in any waters of the state or natural buffer zones.
 - (c) Discharges from dewatering activities shall be managed by appropriate controls. The SWPPP shall include a description of any anticipated dewatering methods and specific BMPs designed to treat dewatering water.
 - 1) Appropriate controls include, but are not limited to, sediment socks, dewatering tanks, tube settlers, weir tanks, filtration systems (e.g. bag or sand filters), and passive treatment systems that are designed to remove or retain sediment.
 - 2) Erosion controls and velocity dissipation devices (e.g. check dams, riprap, and vegetated buffers) to prevent erosion at inlets, outlets, and discharge points shall be utilized.
 - 3) Water with an oil sheen shall not be discharged and shall be marked in SWPPP.
 - 4) Visible floating solids and foam shall not be discharged.
 - (d) Until final stabilization has been achieved, sediment basins and impoundments shall utilize outlet structures or floating skimmers that withdraw water from the surface when discharging.
 - 1) Under frozen conditions, it may be considered infeasible to withdraw water from the surface and an exception can be made for that specific period as long as discharges that may contain sediment and other pollutants are managed by appropriate controls. If determined infeasible due to frozen conditions, documentation must be provided in the SWPPP to support the determination, including the specific conditions or time period when this exception applies.
 - (e) Accumulated sediment shall not exceed 25% of total volume or as prescribed in the design, whichever is less. Note in the SWPPP the locations for disposal of the material removed from sediment basins.
 - (f) Prevent discharges to the receiving stream causing visual turbidity. For the purposes of this permit, visual turbidity refers to a sediment plume or other cloudiness in the water caused by sediment that can be identified by an observer.
 - (g) The SWPPP shall require the basin be maintained until final stabilization of the disturbed area served by the basin.

Where use of a sediment basin is infeasible, the SWPPP shall evaluate and specify other similarly effective BMPs to be employed to control erosion and sediment. These similarly effective BMPs shall be selected from appropriate BMP guidance documents authorized by this permit. The BMPs must provide equivalent water quality protection to achieve compliance with this permit. The SWPPP shall require both temporary and permanent sedimentation basins to have a stabilized spillway to minimize the potential for erosion of the spillway or basin embankment.

12. Soil disturbing activities on site that have ceased either temporarily or permanently shall initiate stabilization immediately in accordance with the options below. For soil disturbing activities that have been temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days:
 - (a) The permittee shall construct BMPs to establish interim stabilization; and
 - (b) Stabilization must be initiated immediately and completed within 14 calendar days.
 - (c) For soil disturbing activities that have been permanently ceased on any portion of the site, final stabilization of disturbed areas must be initiated immediately and completed within 14 calendar days.
 - 1) Extension to the 14-day completion period for temporary and final stabilization may be made due to weather and equipment malfunctions. In these circumstances, the justification for the extension to the 14 day shall be documented in the SWPPP. The discontinuation or continuation of the extension may be determined by review of the Department staff when on site.
 - (d) Until stabilization is complete, interim sediment control shall consist of well-established and maintained BMPs that are reasonably certain to protect waters of the state from sediment pollution over an extended period of time. This may require adding more BMPs to an area than is normally used during daily operations. The types of BMPs used must be suited to the area disturbed, taking into account the number of acres exposed and the steepness of the slopes. If the slope of the area is greater than 3:1 (three feet horizontal to one foot vertical) or if the slope is greater than 3% and greater than 150 feet in length, then the permittee shall establish interim stabilization within seven days of ceasing operations on that part of the site. The following activities would constitute the immediate initiation of stabilization:
 - 1) Prepping the soil for vegetative or non-vegetative stabilization as long as seeding, planting, and/or installation of non-vegetative stabilization products takes place as soon as practicable;
 - 2) Applying mulch or other non-vegetative product to the exposed areas;
 - 3) Seeding or planting the exposed areas;
 - 4) Finalizing arrangements to have stabilization product fully installed in compliance with the deadlines for completing stabilization.
 - (e) If vegetative stabilization measures are being implemented, stabilization is considered "installed" when all activities necessary to seed or plant the area are completed. Installed does not mean established.
 - (f) If non-vegetative stabilization measures are being implemented, stabilization is considered "installed" when all such measures are implemented or applied.
 - 1) Non-vegetative stabilization shall prevent erosion and shall be chosen for site conditions, such as slope and flow of

stormwater.

- (g) Final stabilization is not considered achieved until vegetation has grown and established to meet the requirements below.
13. Prior to removal of BMPs, ceasing site inspections, and requesting termination of the permit, final stabilization must be achieved. Final stabilization shall be achieved as soon as possible once land disturbance activities have ceased. Document in the SWPPP the type of stabilization and the date final stabilization is achieved.
- (a) The project is considered to have achieved final stabilization when perennial vegetation (excluding volunteer vegetation), pavement, buildings, or structures using permanent materials (i.e. riprap, gravel, etc.) cover all areas that have been disturbed. With respect to areas that have been vegetated, vegetation must be at least 70% coverage of 100% of the vegetated areas on site. Vegetation must be evenly distributed.
 - (b) Disturbed areas on agricultural land are considered to have achieved final stabilization when they are restored to their preconstruction agricultural use. If former agricultural land is changing to non-agricultural use, this is no longer considered agricultural land and shall follow condition (a).
 - (c) If the intended function of a specific area of the site necessitates that it remain disturbed, final stabilization is considered achieved if all of the following are met:
 - 1) Only the minimum area needed remains disturbed (i.e. dirt access roads, motocross tracks, utility pole pads, areas being used for storage of vehicles, equipment, materials). Other areas must meet the criteria above.
 - 2) Permanent structural BMPs (rock checks, berms, grading, etc.) or non-vegetative stabilization measures are implemented and designed to prevent sediment and other pollutants from entering waters of the state.
 - 3) Inspection requirements in Part IV. SWPPP MANAGEMENT REQUIREMENT, Condition 11 are met and documented in the SWPPP.
 - (d) Winter weather and frozen conditions do not excuse any of the above final stabilization requirements. If vegetation is required for stabilization the permittee must maintain BMPs throughout winter weather and frozen conditions until thawing and vegetation meets final stabilization criteria above. Document stabilization attempts during frozen conditions in the SWPPP. Consider future freezing when removing vegetation and plan with temporary stabilization techniques before the ground becomes frozen.

VI. PERMIT TERMINATION

- 1. Until the permittee terminates coverage under this permit, the permittee must comply with all conditions in the permit, including continuation of site inspections and public notification signage posted. To terminate permit coverage, the permittee must submit to the appropriate Regional Office a complete and accurate Request for Termination of Operating Permit which certifies that the site meets the following requirements:
 - (a) For any areas that (1) were disturbed during construction, (2) are not covered over by permanent structures, and (3) over which the permittee had control during the construction activities, the requirements for final vegetative or non-vegetative stabilization in Part V BMP REQUIREMENTS, Condition 13;
 - (b) The permittee has removed and properly disposed of all construction materials, waste, and waste handling devices and has removed all equipment and vehicles that were used during construction, unless intended for long-term use following termination of permit coverage;
 - (c) The permittee has removed all temporary BMPs that were installed and maintained during construction, except those that are intended for long-term use following termination of permit coverage or those that are biodegradable; and
 - (d) The permittee has removed all potential pollutants and pollutant-generating activities associated with construction, unless needed for long-term use following termination of permit coverage.

The Department may request photographs that clearly document compliance with termination requirements.

- 2. The permit may be terminated if;
 - (a) There has been a transfer of control of all areas of the site for which the current permittee is responsible under this permit to another operator, and that operator has obtained coverage under this permit; or
 - (b) Coverage under an individual or alternative general NPDES permit, with land disturbance conditions, has been obtained.

VII. SAMPLING REQUIREMENTS

The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site impacts from activities at the site. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.

VIII. STANDARD PERMIT CONDITIONS

1. Records: The permittee shall retain copies of this general permit, the SWPPP and all amendments for the site named in the State Operating Permit, results of any monitoring and analysis, and all site inspection records required by this general permit.
 - (a) The records shall be accessible during normal business hours and retained for a period of at least three (3) years from the date of termination.
 - (b) The permittee shall provide a copy (electronic or otherwise) of the SWPPP to the Department, USEPA, or any local agency or government representative if they request a copy in the performance of their official duties within 24 hours of the request (or next working day), unless given more time by the representative.
 - (c) The permittee shall provide a copy of the SWPPP to those who are responsible for installation, operation, or maintenance of any BMP. The permittee, their representative, and/or the contractor(s) responsible for installation, operation and maintenance of the BMPs shall have a current copy of the SWPPP with them when on the project site.
2. Land Ownership and Change of Ownership: Federal and Missouri stormwater regulations [10 CSR 20-6.200(1) (B)] require a stormwater permit and erosion control measures for all land disturbances of one or more acres. These regulations also require a permit for land disturbance sites less than one acre if the lot is part of a larger common plan of development or sale.
 - (a) If the permittee sells any portion of the permitted site to a developer for commercial, industrial, or residential use, this land remains a part of the common sale and the new owner must obtain a permit prior to conducting any land disturbance activity. Therefore, the original permittee must amend the SWPPP to show that the property has been sold and, therefore, no longer under the original permit coverage.
 - (b) Property of any size which is part of a larger common plan of development where the property has achieved final stabilization and the original permit terminated will require application of a new land disturbance permit for any future land disturbance activity unless the activity is by an individual residential building lot owner on a site less than one acre.
 - (c) If a portion of a larger common plan of development is sold to an individual for the purpose of building his or her own private residence, a permit is required if the disturbed portion of the land sold is equal to or greater than one acre. No permit is required, however, for less than one acre of land disturbed on the portion sold.
3. Permit Transfer: This permit may not be transferred to a new owner in any fashion except by submitting an Application for Transfer of Operating Permit signed by the seller and buyer of the site along with the appropriate modification fee. In some cases, revocation and reissuance may be necessary. Facilities that undergo transfers of ownership without notice to the Department are considered to be operating without a permit.
4. Termination: This permit may be terminated when the project has achieved final stabilization, defined in Part VI. PERMIT TERMINATION.
 - (a) In order to terminate the permit, the permittee shall notify the Department by submitting the form Request for Termination of Operating Permit Form MO 780-2814. The form should be submitted to the appropriate Regional Office or through an approved electronic system if it should become available.
 - (b) The Cover Page (Certificate Page) of the Master General Permit for Land Disturbance specifies the “effective date” and the “expiration date” of the Master General Permit. The “issued date” along with the “expiration date” will appear on the State Operating Permit issued to the applicant. **This permit does not continue administratively beyond the expiration date.**
5. Duty to Reapply: If the project or development completion date will be after the expiration date of this general permit, then the permittee must reapply to the Department for a new permit. This permit may be applied for and issued electronically in accordance with Section 644.051.10, RSMo.
 - (a) Due to the nature of the electronic permitting system, a period of time may be granted at the discretion of the Department in order to apply for a new permit after the new version is effective. Applicants must maintain appropriate best management practices and inspections during the discretionary period.
6. Duty to Comply: The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of the Missouri Clean Water Law and Federal Clean Water Act and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.
7. Modification, Revocation, and Reopening:
 - (a) If at any time the Department determines that the quality of waters of the state may be better protected by reopening this permit, or revoking this permit and requiring the owner/operator of the permitted site to apply for a site-specific permit, the Department may revoke a general permit and require any person to obtain such an operating permit as authorized by 10 CSR20-6.010(13) and 10 CSR 20-6.200(1)(B).

- (b) If this permit is reopened, modified, or revoked pursuant to this Section, the permittee retains all rights under Chapter 536 and 644 Revised Statutes of Missouri upon the Department's reissuance of the permit as well as all other forms of administrative, judicial, and equitable relief available under law.
8. Other Information: Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.
9. Duty to Provide Information: The permittee shall furnish to the Department, within 24 hours unless explicitly granted more time in writing, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The permittee shall also furnish to the Department upon request, copies of records required to be kept by this permit.
10. Inspection and Entry: The permittee shall allow the Department, or an authorized representative (including an authorized contractor acting as a representative of the Department), upon presentation of credentials and other documents as may be required by law, to:
- (a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of the permit;
 - (b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;
 - (c) Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and
 - (d) Sample or monitor at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the Federal Clean Water Act or Missouri Clean Water Law, any substances or parameters at any location.
11. Signatory Requirement:
- (a) All permit applications, reports required by the permit, or information requested by the Department shall be signed and certified. (See 40 CFR 122.22 and 10 CSR 20-6.010)
 - (b) The Federal Clean Water Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit (including monitoring reports or reports of compliance or non-compliance) shall, upon conviction, be punished by a fine of not more than \$10,000 per violation, or by imprisonment for not more than six (6) months per violation, or by both.
 - (c) The Missouri Clean Water Law provides that any person who knowingly makes any false statement, representation or certification in any application, record, report, plan, or other document filed or required to be maintained pursuant to sections 644.006 to 644.141 shall, upon conviction, be punished by a fine of not more than ten thousand dollars, or by imprisonment for not more than six months, or by both.
12. Property Rights: This permit does not convey any property rights of any sort or any exclusive privilege.
13. Notice of Right to Appeal: If you were adversely affected by this decision, you may be entitled to pursue an appeal before the administrative hearing commission (AHC) pursuant to Sections 621.250 and 644.051.6 RSMo. To appeal, you must file a petition with the AHC within thirty days after the date this decision was mailed or the date it was delivered, whichever date was earlier. If any such petition is sent by registered mail or certified mail, it will be deemed filed on the date it is mailed; if it is sent by any method other than registered mail or certified mail, it will be deemed filed on the date it is received by the AHC. Any appeal should be directed to:

Administrative Hearing Commission
U.S. Post Office Building, Third Floor
131 West High Street, P.O. Box 1557
Jefferson City, MO 65102-1557
Phone: 573-751-2422
Fax: 573-751-5018
Website: <https://ahc.mo.gov>

MISSOURI DEPARTMENT OF NATURAL RESOURCES FACT SHEET FOR MASTER GENERAL PERMIT MO-RAxxxxx

The Federal Water Pollution Control Act [Clean Water Act (CWA)] Section 402 of Public Law 92-500 (as amended) established the National Pollution Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States and the release of stormwater from certain point sources. All such discharges are unlawful without a permit (Section 301 of the CWA). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. Missouri State Operating Permits (permit) are issued by the Missouri Department of Natural Resources (Department) under an approved program operated in accordance with federal and state laws (Federal CWA and Missouri Clean Water Law Section 644 as amended). Permits are issued for a period of five (5) years unless otherwise specified.

Per 40 CFR 124.56, 40 CFR 124.8, and 10 CSR 20-6.020(1)(A)2, a Fact Sheet shall be prepared to give pertinent information regarding the applicable regulations, rationale for the development of effluent limitations and conditions, and the public participation process for the permit. A Fact Sheet is not an enforceable part of an MSOP.

DEFINITIONS FOR THE PURPOSES OF THIS PERMIT:

Common Promotional Plan: A plan undertaken by one (1) or more persons to offer lots for sale or lease; where land is offered for sale by a person or group of persons acting in concert, and the land is contiguous or is known, designated, or advertised as a common unit or by a common name or similar names, the land is presumed, without regard to the number of lots covered by each individual offering, as being offered for sale or lease as part of a common promotional plan.

Dewatering: The act of draining rainwater and/or groundwater from basins, building foundations, vaults, and trenches.

Effective Operating Condition: For the purposes of this permit, a stormwater control is kept in effective operating condition if it has been implemented and maintained in such a manner that it is working as designed to minimize pollutant discharges.

Emergency-Related Project: A project initiated in response to a public emergency (e.g. earthquakes, extreme flooding conditions, tornado, disruptions in essential public services, pandemic) for which the related work requires immediate authorization to avoid imminent endangerment to human health/safety or the environment or to reestablish essential public services.

Exposed Soils: For the purposes of this permit, soils that as a result of earth-disturbing activities are left open to the elements.

Immediately: For the purposes of this permit, immediately should be defined as within 24 hours.

Impervious Surface: For the purpose of this permit, any land surface with a low or no capacity for soil infiltration including, but not limited to, pavement, sidewalks, parking areas and driveways, packed gravel or soil, or rooftops.

Infeasible: Infeasible means not technologically possible or not economically practicable and achievable in light of best industry practices.

Install or Installation: When used in connection with stormwater controls, to connect or set in position stormwater controls to make them operational.

Land Disturbance Site or Site: The land or water area where land disturbance activities will occur and where stormwater controls will be installed and maintained. The land disturbance site includes construction support activities, which may be located at a different part of the property from where the primary land disturbance activity will take place or on a different piece of property altogether. Off-site borrow areas directly and exclusively related to the land disturbance activity are part of the site and must be permitted.

Larger Common Plan of Development or Sale: A continuous area where multiple separate and distinct construction activities are occurring under one plan, including any offsite borrow areas that are directly and exclusively related to the land disturbance activity. Off-site borrow areas utilized for multiple different land disturbance projects are considered their own entity and are not part of the larger common plan of development or sale. See definition of Common Promotional Plan to understand what a 'common plan' is.

Minimize: To reduce and/or eliminate to the extent achievable using stormwater controls that are technologically available and economically practicable and achievable in light of best industry practices.

Non-structural BMP: Institutional, educational, or pollution prevention practices designed to limit the amount of stormwater runoff or

pollutants that are generated in the landscape. Examples of non-structural BMPs include picking up trash and debris, sweeping up nearby sidewalks and streets, maintaining equipment, and training site staff on stormwater control practices.

Operational: for the purposes of this permit, stormwater controls are made “operational” when they have been installed and implemented, are functioning as designed, and are properly maintained.

Ordinary High Water Mark: The line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris.

Outfall: For the purposes of this permit, outfalls are locations where stormwater exits the site property, including pipes, ditches, swales, channels, or other conduits that transport stormwater discharges associated with the construction activity.

Peripheral: For the purposes of this permit, peripheral should be defined as the outermost boundary of the area that will be disturbed.

Permanently: For the purposes of this permit, permanently is defined as any activity that has been ceased without any intentions of future disturbance.

Pollution Prevention Controls (or Measures): Stormwater controls designed to reduce or eliminate the addition of pollutants to construction site discharges through analysis of pollutant sources, implementation of proper handling/disposal practices, employee education, and other actions.

Qualified Person (inspections): A person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Stormwater Control (also referred to as sediment/erosion controls): refers to any temporary or permanent BMP or other method used to prevent or reduce the discharge of pollutants to waters of the state.

Structural BMP: Physical sediment/erosion controls working individually or as a group (treatment train) appropriate to the source, location, and area climate for the pollutant to be controlled. Examples of structural BMPs include silt fences, sedimentation ponds, erosion control blankets, and seeding.

Temporary Stabilization: A condition where exposed soils or disturbed areas are provided temporary vegetation and/or non-vegetative protective cover to prevent erosion and sediment loss. Temporary stabilization may include temporary seeding, geotextiles, mulches, and other techniques to reduce or eliminate erosion until either final stabilization can be achieved or until further construction activities take place to re-disturb this area.

Treatment Train: A multi-BMP approach to managing the stormwater volume and velocity and often includes erosion prevention and sediment control practices often applied when the use of a single BMP is inadequate in preventing the erosion and transport of sediment. A good option to utilize as a corrective action.

Volunteer Vegetation: A volunteer plant is a plant that grows on its own, rather than being deliberately planted for stabilization purposes. Volunteers often grow from seeds that float in on the wind, are dropped by birds, or are inadvertently mixed into soils. Commonly, volunteer vegetation is referred to as ‘weeds’. This does not meet the requirements for final stabilization.

Waters of the State: Section 644.016.1(27) RSMo. defines waters of the state as, “All waters within the jurisdiction of this state, including all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two or more persons jointly or as tenants in common.”

EXAMPLES OF TYPES; BUT NOT LIMITED TO’S:

Building materials and building products typically present at constructions sites: Asphalt sealants, copper flashing, roofing materials, adhesives, concrete admixtures, and gravel and mulch stockpiles

Construction and domestic (solid) waste: Packaging materials, scrap construction materials, masonry products, timber, pipe and electrical cuttings, plastics, Styrofoam, concrete, demolition debris, and other trash or building materials.

Hazardous or toxic waste that may be present at construction sites: Caulks, sealants, fluorescent light ballasts (mercury), solvents, petroleum-based products, wood preservatives, additives, curing compounds, and acids.

Pollutant-generating activities: Paving operations; concrete, paint, and stucco washout and waste disposal; solid waste storage and disposal; and dewatering activities.

Types of pollutants typically found at constructions sites: Sediment; nutrients; heavy metals; pesticides and herbicides; oil and grease; bacteria and viruses; trash, debris, and solids; treatment polymers; and any other toxic chemicals.

BMPs for Erosion Control: Temporary/permanent seeding, hydroseeding, mulch and hydromulch, erosion control blankets, dust control, sodding, slope protection, and preservation of existing vegetation.

BMPs for Sediment Control: Fabric drop inlet protection, excavated drop inlet protection, block and gravel inlet protection, domed inlet protection, inlet bag or insert, silt fence, temporary diversion, right-of-way/diversion bar, temporary slope drain, subsurface drain, rock outlets, berms, filter socks, transition mats, temporary sediment trap, energy dissipaters, rock check dam, ditch checks, wattles, straw bale barrier, vegetative buffer strip, sediment basin, particle curtains, frog logs, and dispersion fields.

E Permitting for Land Disturbance

In order to apply for the states MO-RA land disturbance permit you will need to utilize the Department's online ePermitting system. In order to access this, you will need to register an account with the Missouri Gateway for Environmental Management (MoGEM). The following user guides will assist you with this process.

MoGEM Website: <https://dnr.mo.gov/data-e-services/missouri-gateway-environmental-management-mogem>

ePermitting Website: <https://dnr.mo.gov/data-e-services/water/electronic-permitting-epermitting>

How to Register: <https://dnr.mo.gov/document-search/registering-new-user-account-within-missouri-gateway-environmental-management-mogem-portal>

ePermitting User Guides: (found on ePermitting website)

- How to Add a Facility: <https://dnr.mo.gov/document-search/epermitting-chapter-2-home-facility-search-associate-new-facility>
- How to Apply for a Permit: <https://dnr.mo.gov/document-search/epermitting-chapter-3-create-new-permit>.

PART I – BASIC PERMIT INFORMATION

Facility Type:	Industrial Stormwater; Land Disturbance
Facility SIC Code(s):	1629
Facility Description:	Construction or land disturbance activity (e.g., clearing, grubbing, excavating, grading, filling, and other activities that result in the destruction of the root zone and/or land disturbance activity that is reasonably certain to cause pollution to waters of the state).

This permit establishes a SWPPP requirement for pollutants of concern from all facilities covered under this permit. 10 CSR 20-6.200(7) specifies "general permits shall contain BMP requirements and/or monitoring and reporting requirements to keep the stormwater from becoming contaminated".

Land disturbance activities include clearing, grubbing, excavating, grading, filling and other activities that result in the destruction of the root zone and/or other activities that are reasonably certain to cause pollution to waters of the state.

A Missouri State Operating Permit for land disturbance permit is required for construction disturbance activities of one or more acres, or for construction activities that disturb less than one acre when they are part of a larger common plan of development or sale that will disturb a cumulative total of one or more acres over the life of the project per 10CSR 20-6.200(1)(D)28.

The primary requirement of a land disturbance permit is the development of a SWPPP which incorporates site-specific BMPs to minimize soil exposure, soil erosion, and the discharge of pollutants. The SWPPP ensures the design, implementation, management and maintenance of BMPs in order to prevent sediment and other pollutants from leaving the site.

When it precipitates, stormwater washes over the loose soil on a construction site and various other materials and products being stored outside. As stormwater flows over the site, it can pick up pollutants like sediment, debris, and chemicals from the loose soil and transport them to nearby storm sewer systems or directly into rivers, lakes, or coastal waters. The Missouri Department of Natural Resources is responsible for ensuring that construction site operators have the proper stormwater controls in place so that construction can proceed in a way that protects your community's clean water and the surrounding environment. One way the department helps protect water quality is by issuing land disturbance permits.

Local conditions are not considered when developing conditions for a general permit. A facility may apply for a site-specific permit if they desire a review of site-specific conditions.

CHANGES TO THE RENEWAL OF THIS PERMIT INCLUDE:

While drafting this permit for renewal, the Department hosted three public meetings held on January 27, February 17, and March 9, 2021, which allowed stakeholders to voice concerns about conditions within the permit and submit comments during the period of initial stakeholder involvement. These concerns were taken into consideration when drafting the permit. In addition to these meetings, the Department also held an informal review period for stakeholders to review the draft prior to the 30 day public comment period.

- Updated language throughout the permit to current permit language used by the Department and EPA.
- Added language for emergency related projects.
- Clarified conditions which were ambiguous.
- Reorganized sections/conditions for logical progression.
- Authorized permit transfers and some modifications.
- Sections added for termination procedures, discharges to special streams, and procedures for concrete washout.

PART II – RECEIVING STREAM INFORMATION

APPLICABLE DESIGNATIONS OF WATERS OF THE STATE:

Per Missouri Effluent Regulations (10 CSR 20-7.015), the waters of the state are divided into seven (7) categories. This permit applies to facilities discharging to the following water body categories:

- ✓ Missouri or Mississippi River [10 CSR 20-7.015(2)]
- ✓ Lakes or Reservoirs [10 CSR 20-7.015(3)]
- ✓ Losing Streams [10 CSR 20-7.015(4)]
- ✓ Metropolitan No-Discharge Streams [10 CSR 20-7.015(5)]
- ✓ Special Streams [10 CSR 20-7.015(6)]
- ✓ Subsurface Waters [10 CSR 20-7.015(7)]
- ✓ All Other Waters [10 CSR 20-7.015(8)]

Missouri Water Quality Standards (10 CSR 20-7.031) defines the Clean Water Commission water quality objectives in terms of "water uses to be maintained and the criteria to protect those uses." The receiving stream and/or 1st classified receiving stream's designated water uses shall be maintained in accordance with 10 CSR 20-7.031(24). A general permit does not take into consideration site-specific conditions.

MIXING CONSIDERATIONS:

This permit applies to receiving streams of varying low flow conditions. Therefore, the effluent limitations must be based on the smallest low flow streams considered, which includes waters without designated uses. As such, no mixing is allowed [10 CSR 20-7.031(5)(A)4.B.(I)(a)]. No Zone of Initial Dilution is allowed. [10 CSR 20-7.031(5)(A)4.B.(I)(b)].

RECEIVING STREAM MONITORING REQUIREMENTS:

There are no receiving water monitoring requirements recommended at this time.

PART III – RATIONALE AND DERIVATION OF EFFLUENT LIMITATIONS & PERMIT CONDITIONS

305(B) REPORT, 303(d) LIST, & TOTAL MAXIMUM DAILY LOAD (TMDL):

Section 305(b) of the Federal CWA requires each state identify waters not meeting Water Quality Standards and for which adequate water pollution controls have not been required. Water Quality Standards protect such beneficial uses of water as whole body contact, maintaining fish and other aquatic life, and providing drinking water for people, livestock, and wildlife. The 303(d) report, which includes the 303(d) list, helps state and federal agencies keep track of waters which are impaired but not addressed by normal water pollution control programs.

A TMDL is a calculation of the maximum amount of a given pollutant a body of water can absorb before its water quality is affected. If a water body is determined to be impaired as listed on the 303(d) list, then a watershed management plan will be developed which shall include the TMDL calculation. For facilities with an existing general permit before a TMDL is written on their receiving stream, the Department will evaluate the permit and may require any facility authorized by this general permit to apply for and obtain a site-specific operating permit.

ANTI-BACKSLIDING:

A provision in the Federal Regulations [CWA Section 303(d)(4); CWA Section 402(c); 40 CFR Part 122.44(I)] requires a reissued permit to be as stringent as the previous permit with some exceptions.

✓ Not Applicable: All effluent limitations in this permit are at least as protective as those previously established.

ANTIDegradation:

Antidegradation policies ensure protection of water quality for a particular water body on a pollutant by pollutant basis to ensure Water Quality Standards are maintained to support beneficial uses such as fish and wildlife propagation and recreation on and in the water. This also includes special protection of waters designated as an Outstanding National Resource Water or Outstanding State Resource Water [10 CSR 20-7.031(3)(C)]. Antidegradation policies are adopted to minimize adverse effects on water.

The Department has determined the best avenue forward for implementing the Antidegradation requirements into general stormwater permits is by requiring the appropriate development and maintenance of a SWPPP. The SWPPP must identify all reasonable and effective BMPs, taking into account environmental impacts and costs. This analysis must document why no discharge or no exposure options are not feasible at the facility. This selection and documentation of appropriate control measures will then serve as the analysis of alternatives and fulfill the requirements of the Antidegradation Rule and Implementation Procedure 10 CSR 20-7.031(3) and 10 CSR 20-7.015(9)(A)5.

Any facility seeking coverage under this permit which undergoes expansion or discharges a new pollutant of concern must update their SWPPP and select reasonable and cost effective new BMPs. New facilities seeking coverage under this permit are required to develop a SWPPP including this analysis and documentation of appropriate BMPs. Renewal of coverage for a facility requires a review of the SWPPP to ensure the selected BMPs continue to be appropriate.

✓ Applicable; the facility must review and maintain stormwater BMPs as appropriate.

BENCHMARKS:

When a permitted feature or outfall consists of only stormwater, a benchmark may be implemented at the discretion of the permit writer. Benchmarks require the facility to monitor and, if necessary, replace and update stormwater control measures. Benchmark concentrations are not effluent limitations. A benchmark exceedance, therefore, is not a permit violation; however, failure to take corrective action is a violation of the permit. Benchmark monitoring data is used to determine the overall effectiveness of control measures and to assist the permittee in knowing when additional corrective actions may be necessary to comply with the limitations of the permit.

✓ Not applicable; this facility has stormwater-only outfalls and does not contain numeric benchmarks.

BEST MANAGEMENT PRACTICES:

Minimum site-wide BMPs are established in this permit to ensure all permittees are managing their sites equally to protect waters of the state from certain activities which could cause negative effects in receiving water bodies. If the minimum BMPs are not followed, the facility may violate general criteria [10 CSR 20-7.031(4)]. Statutes are applicable to all permitted facilities in the state; therefore, pollutants cannot be released unless in accordance with RSMo 644.011 and 644.016 (17).

During a short time period, construction sites can contribute more sediment to streams than can be deposited naturally during several decades. The resulting siltation and contribution of other pollutants from construction sites can cause physical, chemical, and biological harm to Missouri's waters. Land disturbance activities, such as clearing and grading the land surface, increases the potential for sediment discharges.

The previous version of this permit contained the majority of the BMPs required in this permit and were found to protect water quality. Additional BMPs were added to improve protections with language taken from the EPA's Construction General Permit.

Language was added for track out to clarify and to combine with the roadway conditions in the previous permit. Preventing sediment from entering roadway inlets will protect water quality. Requirements were added for concrete wash out management. This is a common activity on construction sites which had not been address in the previous permit. Containment of the wash out water will protect waters of the state. This language was adopted from the EPAs Construction General Permit.

This renewal requires certain operators be listed in the SWPPP, this was added to ensure all responsible parties are known to the staff on site in the event there is an environmental issue that needs attention.

Inspection conditions were added to clarify what parts of the site to inspect. By inspecting areas prone to pollution, such as material storage, or location where pollutants are like to leave the site, such as the outfall, there is increased protections to water quality by stopping pollutants before leaving the site, or correcting an issue quickly.

Inspection frequencies were reduced for areas where stabilization has been achieved. It was the permit writer's judgement that stabilized areas do not require inspections at the same frequency as active areas of a site as the stabilization is a BMP to reduce sediment loss. Additional inspections are required for sediment basin dewatering activities during times of dewatering. These activities

open the possibility for high volumes of sediment to be discharged into the receiving waters. By inspecting the discharge, the waters shall be better protected. Language was added to add the temporary reduction of inspections for areas that have frozen ground.

Condition was added for stockpile management to add clarity for operators on site. Migration of soil or product from mis-managed piles can enter waters of the state and cause water quality violations. Conditions were added to sediment basin dewater to increase the protection of receiving waters by increasing controls to retain sediment and keep it out of the discharged water.

Language was added to include National and State Resource Waters with added protections. Language for this was taken from the template for Missouri General Permits. These requirements also include waters with impairments for sediment, the pollutant of concern under this permit. Extra protections in these special stream requirements were added to clarify the discharges must be stormwater only.

Language was added to include the encouragement of preserving vegetation, trees, and soil. Clearing reduces the natural uptake of water and nutrients by vegetation and excessive grading can smooth the ground surface, increasing amount and velocity of runoff. Vegetation inhibits erosion as the roots hold the topsoil in place, while leaves protect the surface against rain. Once the vegetative cover is gone, erosion is accelerated. The longer the exposed area is subject to erosive forces, the more severe the effect. Clarification was added to define voluntary vegetation and to explain that these shallow rooted short-lived vegetation is not allowed as permanent stabilization.

CHANGES IN DISCHARGES OF TOXIC POLLUTANT:

This special condition reiterates the federal rules found in 40 CFR 122.44(f) and 122.42(a)(1). In these rules, the facility is required to report changes in amounts of toxic substances discharged. Toxic substances are defined in 40 CFR 122.2 as "...any pollutant listed as toxic under section 307(a)(1) or, in the case of "sludge use or disposal practices," any pollutant identified in regulations implementing section 405(d) of the CWA." Section 307 of the clean water act then refers to those parameters found in 40 CFR 401.15. The permittee should also consider any other toxic pollutant in the discharge as reportable under this condition.

DOMESTIC WASTEWATER, SLUDGE, AND BIOSOLIDS:

Domestic wastewater is defined as wastewater (i.e., human sewage) originating primarily from the sanitary conveyances of bathrooms and kitchens. Domestic wastewater excludes stormwater, animal waste, process waste, and other similar waste.

- ✓ Not applicable; this permit does not authorize discharge of domestic waste, sludge, or biosolids. This includes discharges to onsite lagoons. If a facility has an onsite lagoon, they may need to obtain a separate general or site specific permit to cover discharges or land application from this structure.

Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works. Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for productive use (i.e. fertilizer) and after having pathogens removed.

- ✓ Not applicable; this permit does not authorize discharge or land application of biosolids or sludge. A separate permit must be obtained for these activities, either general or site specific.

EFFLUENT LIMITATION GUIDELINE:

Effluent Limitation Guidelines, or ELGs, are found at 40 CFR 400-499. These are limitations established by the EPA based on the SIC code and the type of work a facility is conducting. Most ELGs are for process wastewater and some address stormwater. All are technology based limitations which must be met by the applicable facility at all times.

- ✓ The industries covered under this permit have an associated Effluent Limit Guideline (ELG) which is applicable to the stormwater discharges in this permit and is applied under 40 CFR 125.3(a).

ELECTRONIC DISCHARGE MONITORING REPORT (EDMR) SUBMISSION SYSTEM:

The U.S. Environmental Protection Agency (EPA) promulgated a final rule on October 22, 2015, to modernize Clean Water Act reporting for municipalities, industries, and other facilities by converting to an electronic data reporting system. The final rule requires regulated entities and state and federal regulators to use information technology to electronically report data required by the National Pollutant Discharge Elimination System (NPDES) permit program instead of filing paper reports. To comply with the federal rule, the Department is requiring all permittees to begin submitting discharge monitoring data and reports online.

- ✓ Not applicable; this permit has no limits to report.

GENERAL CRITERIA CONSIDERATIONS:

In accordance with 40 CFR 122.44(d)(1), effluent limitations shall be placed into permits for pollutants determined to cause, have reasonable potential to cause, or to contribute to, an excursion above any water quality standard, including narrative water quality criteria. In order to comply with this regulation, the permit writer has completed a reasonable potential determination on whether

discharges have reasonable potential to cause or contribute to an excursion of the general criteria listed in 10 CSR 20-7.031(4). In instances where reasonable potential exists, the permit includes limitations within the permit to address the reasonable potential. In discharges where reasonable potential does not exist, the permit may include monitoring to later determine the discharge's potential to impact the narrative criteria. Additionally, RSMo 644.076.1, as well as Standard Permit Conditions Part VIII of this permit state it shall be unlawful for any person to cause or allow any discharge of water contaminants from any water contaminant or point source located in Missouri in violation of sections 644.006 to 644.141 of the Missouri Clean Water Law or any standard, rule, or regulation promulgated by the commission.

LAND APPLICATION:

Land application, or surficial dispersion of wastewater and/or sludge, is performed by facilities to maintain a basin as no-discharge. Requirements for these types of operations are found in 10 CSR 20-6.015; authority to regulate these activities is from RSMo 644.026.

- ✓ Not applicable; this permit does not authorize operation of a surficial land application system to disperse wastewater or sludge.

LAND DISTURBANCE:

Land disturbance, sometimes called construction activities, are actions which cause disturbance of the root layer or soil; these include clearing, grading, and excavating of the land. 40 CFR 122.26(b)(14) and 10 CSR 20-6.200(3) requires permit coverage for these activities. Coverage is not required for facilities when only providing maintenance of original line and grade, hydraulic capacity, or to continue the original purpose of the facility.

- ✓ Applicable; this permit provides coverage for land disturbance activities. These activities have SWPPP requirements and may be combined with the standard site SWPPP. Land disturbance BMPs should be designed to control the expected peak discharges. The University of Missouri has design storm events for the 25 year 24 hour storm; these can be found at: http://ag3.agebb.missouri.edu/design_storm/comparison_reports/20191117_25yr_24hr_comparison_table.htm; to calculate peak discharges, the website <https://www.lmnoeng.com/Hydrology/rational.php> has the rational equation to calculate expected discharge volume from the peak storm events.

NUTRIENT MONITORING:

Nutrient monitoring is required for facilities characteristically or expected to discharge nutrients (nitrogenous compounds and/or phosphorus) when the design flow is equal to or greater than 0.1 MGD per 10 CSR 20-7.015(9)(D)8.

- ✓ This is a stormwater only permit; therefore, it is not subject to provisions found in 10 CSR 20-7.015 per 10 CSR 20-7.015(1)(C).

OIL/WATER SEPARATORS:

Oil water separator (OWS) tank systems are frequently found at industrial sites where process water and stormwater may contain oils and greases, oily wastewaters, or other immiscible liquids requiring separation. Food industry discharges typically require pretreatment prior to discharge to municipally owned treatment works. Per 10 CSR 26-2.010(2)(B), all oil water separator tanks must be operated according to manufacturer's specifications and authorized in NPDES permits per 10 CSR 26-2.010(2) or may be regulated as a petroleum tank.

- ✓ Not applicable; this permit does not authorize the operation of OWS. The facility must obtain a separate permit to cover operation of and discharge from these devices.

OPERATOR CERTIFICATION REQUIREMENTS:

As per 10 CSR 20-6.010(8) Terms and Conditions of a Permit, permittees shall operate and maintain facilities to comply with the Missouri Clean Water Law and applicable permit conditions and regulations. Operators or supervisors of operations at regulated wastewater treatment facilities shall be certified in accordance with [10 CSR 20-9.020(2)] and any other applicable state law or regulation.

- ✓ Not applicable; the facilities covered under this permit are not required to have a certified operator.

PERMIT SHIELD:

The permit shield provision of the Clean Water Act (Section 402(k)) and Missouri Clean Water Law (644.051.16 RSMo) provides that when a permit holder is in compliance with its NPDES permit or MSOP, they are effectively in compliance with certain sections of the Clean Water Act and equivalent sections of the Missouri Clean Water Law. In general, the permit shield is a legal defense against certain enforcement actions but is only available when the facility is in compliance with its permit and satisfies other specific conditions, including having completely disclosed all discharges and all facility processes and activities to the Department at time of application. It is the facility's responsibility to ensure that all potential pollutants, waste streams, discharges, and activities, as well as wastewater land application, storage, and treatment areas, are all fully disclosed to the Department at the time of application or during the draft permit review process. Subsequent requests for authorization to discharge additional pollutants or expanded or newly disclosed flows, or for authorization for previously unpermitted and undisclosed activities or discharges, will likely require permit modification or may require the facility be covered under a site specific permit.

PRETREATMENT PROGRAM:

This permit does not regulate pretreatment requirements for facilities discharging to an accepting permitted wastewater treatment facility. If applicable, the receiving entity (the publicly owned treatment works - POTW) must ensure compliance with any effluent

limitation guidelines for pretreatment listed in 40 CFR Subchapter N per 10 CSR 20-6.100. Pretreatment regulations per RSMo 644.016 are limitations on the introduction of pollutants or water contaminants into publicly owned treatment works or facilities.

- ✓ Not Applicable; the facilities covered under this permit are not required to meet pretreatment requirements under an ELG.

PUBLIC NOTICE OF COVERAGE FOR AN INDIVIDUAL FACILITY:

Public Notice of reissuance of coverage is not required unless the facility is a specific type of facility as defined in 10 CSR 20-6.200(1). The need for an individual public notification process shall be determined and identified in the permit [10 CSR 20-6.020(1)(C)5.].

- ✓ Not applicable; public notice is not required for coverage under this permit to individual facilities. The MGP is public noticed in lieu of individual permit PN requirements.

REASONABLE POTENTIAL ANALYSIS (RPA):

Federal regulation 40 CFR Part 122.44(d)(1)(i) requires effluent limitations for all pollutants which are or may be discharged at a level which will cause or have the reasonable potential to cause or contribute to an in-stream excursion above narrative or numeric water quality standard. In accordance with 40 CFR Part 122.44(d)(iii) if the permit writer determines any given pollutant has the reasonable potential to cause or contribute to an in-stream excursion above the water quality standard, the permit must contain effluent limits for the pollutant.

- ✓ The permit writer reviewed industry materials, available past inspections, and other documents and research to evaluate general and narrative water quality reasonable potential for this permit. Permit writers also use the Department's permit writer's manual, the EPA's permit writer's manual (<https://www.epa.gov/npdes/npdes-permit-writers-manual>), program policies, and best professional judgment. For each parameter in each permit, the permit writer carefully considers all applicable information regarding technology based effluent limitations, effluent limitation guidelines, and water quality standards. Best professional judgment is based on the experience of the permit writer, cohorts in the Department and resources at the EPA, research, and maintaining continuity of permits if necessary. For stormwater permits, the permit writer is required per 10 CSR 6.200(6)(B)2 to consider: A. application and other information supplied by the permittee; B. effluent guidelines; C. best professional judgment of the permit writer; D. water quality; and E. BMPs.

SCHEDULE OF COMPLIANCE (SOC):

Per § 644.051, RSMo, a permit may be issued with a Schedule of Compliance (SOC) to provide time for a facility to come into compliance with new state or federal effluent regulations, water quality standards, or other requirements. Such a schedule is not allowed if the facility is already in compliance with the new requirement or if prohibited by other statute or regulation. An SOC includes an enforceable sequence of interim requirements (e.g. actions, operations, or milestone events) leading to compliance with the Missouri Clean Water Law, its implementing regulations, and/or the terms and conditions of an operating permit. *See also* Section 502(17) of the Clean Water Act, and 40 CFR 122.2. For new effluent limitations, the permit may include interim monitoring for the specific parameter to demonstrate the facility is not already in compliance with the new requirement. Per 40 CFR 122.47(a)(1) and 10 CSR 20-7.031(11), compliance must occur as soon as possible. If the permit provides a schedule for meeting new water quality based effluent limits, an SOC must include an enforceable, final effluent limitation in the permit even if the SOC extends beyond the life of the permit.

- ✓ Not Applicable: This permit does not contain a SOC.

SETBACKS:

Setbacks, sometimes called separation distances, are common elements of permits and are established to provide a margin of safety in order to protect the receiving water and other features from accidents, spills, unusual events, etc. Specific separation distances are included in 10 CSR 20-8 for minimum design standards of wastewater structures. While wastewater is considered separately from stormwater under this permit, the guides and Chapter 8 distances may remain relevant to requirements under this permit if deemed appropriate by the permittee.

- ✓ Discharge to the watersheds of a Metropolitan No-Discharge Stream (10 CSR 20-7.031 Table F) is authorized by this permit if the discharges are in compliance with 10 CSR 20-7.015(5) and 10 CSR 20-7.031(7). Discharges to these watersheds are authorized for uncontaminated stormwater discharges only.
- ✓ This permit authorizes stormwater discharges which are located in a way to allow water to be released into sinkholes, caves, fissures, or other openings in the ground which could drain into aquifers (except losing streams) per 10 CSR 20-7.015(7). It is the best professional judgment of the permit writer to allow discharges to losing streams as the effluent is stormwater only.
- ✓ This permit authorizes stormwater discharge in the watersheds of Outstanding state Resource Waters (OSRW); Outstanding National Resources Waters (ONRW), which includes the Ozark National Riverways and the National Wild and Scenic Rivers System; and impaired waters as designated in the 305(b) report, including the 303(d), list so long as no degradation of water quality occurs in the OSRW and ONRW due to discharges from the permitted facility per 10 CSR 20-7.015(6)(B) and 10 CSR 20-7.031(3)(C).

Additionally, if the facility is found to be causing degradation or contributing to an impairment by discharging a pollutant of concern during an inspection or through complaint investigations, they will be required to become a no discharge facility or obtain a site specific permit with more stringent monitoring and SWPPP requirements. Missouri's impaired waters can be found at <https://dnr.mo.gov/water/what-were-doing/water-planning/quality-standards-impaired-waters-total-maximum-daily->

[loads/impaired-waters](#). Sites within 1000 feet of a OSRW, ONRW, or water impaired for sediment must operate as a no-discharge facility. These additional protections are borrowed from the USEPA 2021 draft Construction General Permit.

SLUDGE – DOMESTIC BIOSOLIDS:

Biosolids are solid materials resulting from domestic wastewater treatment meeting federal and state criteria for beneficial use (i.e. fertilizer). Sewage sludge is solid, semi-solid, or liquid residue generated during the treatment of domestic sewage in a treatment works; including, but not limited to, domestic septage; scum or solids removed in primary, secondary, or advanced wastewater treatment process; and material derived from sewage sludge. Sewage sludge does not include ash generated during the firing of sewage sludge in a sewage sludge incinerator or grit and screening generated during preliminary treatment of domestic sewage in a treatment works.

✓ This permit does not authorize discharge or land application of biosolids. Sludge/biosolids is not generated by this industry.

SLUDGE – INDUSTRIAL:

Industrial sludge is solid, semi-solid, or liquid residue generated during the treatment of industrial process wastewater in a treatment works; including, but not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment process; scum and solids filtered from water supplies and backwashed; and a material derived from industrial sludge.

✓ Not applicable; sludge is not generated by this industry.

SPILL REPORTING:

Any emergency involving a hazardous substance must be reported to the Department's 24 hour Environmental Emergency Response hotline at (573) 634-2436 at the earliest practicable moment after discovery. The Department may require the submittal of a written report detailing measures taken to clean up a spill. These reporting requirements apply when the spill results in chemicals or materials leaving the permitted property or reaching waters of the state. This requirement is in addition to the noncompliance reporting requirement found in Standard Conditions Part I. <https://dnr.mo.gov/waste-recycling/investigations-cleanups/environmental-emergency-response>.

Underground and above ground storage devices for petroleum products, vegetable oils, and animal fats may be subject to control under federal Spill Prevention, Control, and Countermeasure Regulation and are expected to be managed under those provisions, if applicable. Substances regulated by federal law under the Resource Conservation and Recovery Act (RCRA) or the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which are transported, stored, or used for maintenance, cleaning or repair shall be managed according to the provisions of RCRA and CERCLA.

STORMWATER POLLUTION PREVENTION PLAN (SWPPP):

In accordance with 40 CFR 122.44(k), BMPs must be used to control or abate the discharge of pollutants when: 1) Authorized under section 304(e) of the Clean Water Act (CWA) for the control of toxic pollutants and hazardous substances from ancillary industrial activities; 2) Authorized under section 402(p) of the CWA for the control of stormwater discharges; 3) Numeric effluent limitations are infeasible; or 4) the practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of the CWA. In accordance with the EPA's *Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites*, (Document number EPA 833-R-06-004) published by the EPA in 2007 https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf, BMPs are measures or practices used to reduce the amount of pollution entering waters of the state from a permitted facility. BMPs may take the form of a process, activity, or physical structure. Additionally, in accordance with the Stormwater Management, a SWPPP is a series of steps and activities to 1) identify sources of pollution or contamination, and 2) select and carry out actions which prevent or control the pollution of storm water discharges. Additional information can be found in *Stormwater Management for Industrial Activities: Developing Pollution Prevention Plans and Best Management Practices* (EPA 832-R-92-006; September 1992).

A SWPPP must be prepared if the SIC code for the facility is found in 40 CFR 122.26(b)(14) and/or 10 CSR 20-6.200(2). A SWPPP may be required of other facilities where stormwater has been identified as necessitating better management. The purpose of a SWPPP is to comply with all applicable stormwater regulations by creating an adaptive management plan to control and mitigate stream pollution from stormwater runoff. Developing a SWPPP provides opportunities to employ appropriate BMPs to minimize the risk of pollutants being discharged during storm events. The following paragraph outlines the general steps the permittee should take to determine which BMPs will work to achieve the benchmark values or limits in the permit. This section is not intended to be all encompassing or restrict the use of any physical BMP or operational and maintenance procedure assisting in pollution control. Additional steps or revisions to the SWPPP may be required to meet the requirements of the permit.

Areas which should be included in the SWPPP are identified in 40 CFR 122.26(b)(14). Once the potential sources of stormwater pollution have been identified, a plan should be formulated to best control the amount of pollutant being released and discharged by each activity or source. This should include, but is not limited to, minimizing exposure to stormwater, good housekeeping measures, proper facility and equipment maintenance, spill prevention and response, vehicle traffic control, and proper materials handling. Once a plan has been developed, the facility will employ the control measures determined to be adequate to prevent pollution from entering waters of the state. The facility will conduct inspections of the BMPs to ensure they are working properly and re-evaluate any BMP

not achieving compliance with permitting requirements. For example if the BMP being employed is deficient in controlling stormwater pollution, corrective action should be taken to repair, improve, or replace the failing BMP. If failures do occur, continue this trial and error process until appropriate BMPs have been established.

The EPA has developed factsheets on the pollutants of concern for specific industries along with the BMPs to control and minimize stormwater (<https://www.epa.gov/npdes/stormwater-discharges-industrial-activities>). Along with EPA's factsheets, the International Stormwater BMP database (<https://bmpdatabase.org/>) may provide guidance on BMPs appropriate for specific industries.

For new, altered, or expanded stormwater discharges, the SWPPP shall identify reasonable and effective BMPs while accounting for environmental impacts of varying control methods. The antidegradation analysis must document why no discharge or no exposure options are not feasible. The selection and documentation of appropriate control measures shall serve as an alternative analysis of technology and fulfill the requirements of antidegradation [10 CSR 20-7.031(3)].

Alternative analysis evaluation of the BMPs is a structured evaluation of BMPs which are reasonable and cost effective. The alternative analysis evaluation should include practices designed to be: 1) non-degrading; 2) less degrading; or 3) degrading water quality. The glossary of the *Antidegradation Implementation Procedure* defines these three terms. The chosen BMP will be the most reasonable and effective management strategy while ensuring the highest statutory and regulatory requirements are achieved and the highest quality water attainable for the facility is discharged. The alternative analysis evaluation must demonstrate why "no discharge" or "no exposure" is not a feasible alternative at the facility. This structured analysis of BMPs serves as the antidegradation review, fulfilling the requirements of 10 CSR 20-7.031(3) Water Quality Standards and *Antidegradation Implementation Procedure*, Section II.B.

- ✓ Applicable: A SWPPP shall be developed and implemented for each site and shall incorporate required practices identified by the Department with jurisdiction, incorporate control practices specific to site conditions, and provide for maintenance and adherence to the plan.

UNDERGROUND INJECTION CONTROL (UIC):

The UIC program for all classes of wells in the State of Missouri is administered by the Missouri Department of Natural Resources and approved by EPA pursuant to section 1422 and 1425 of the Safe Drinking Water Act (SDWA) and 40 CFR 147 Subpart AA. Injection wells are classified based on the liquids which are being injected. Class I wells are hazardous waste wells which are banned by RSMo 577.155; Class II wells are established for oil and natural gas production; Class III wells are used to inject fluids to extract minerals; Class IV wells are also banned by Missouri in RSMo 577.155; Class V wells are shallow injection wells; some examples are heat pump wells and groundwater remediation wells. Domestic wastewater being disposed of sub-surface is also considered a Class V well. In accordance with 40 CFR 144.82, construction, operation, maintenance, conversion, plugging, or closure of injection wells shall not cause movement of fluids containing any contaminant into Underground Sources of Drinking Water (USDW) if the presence of any contaminant may cause a violation of drinking water standards or groundwater standards under 10 CSR 20-7.031 or other health-based standards or may otherwise adversely affect human health. If the Department finds the injection activity may endanger USDWs, the Department may require closure of the injection wells or other actions listed in 40 CFR 144.12(c), (d), or (e). In accordance with 40 CFR 144.26, the permittee shall submit a Class V Well Inventory Form for each active or new underground injection well drilled, or when the status of a well changes, to the Missouri Department of Natural Resources, Geological Survey Program, P.O. Box 250, Rolla, Missouri 65402. Single family residential septic systems and non-residential septic systems used solely for sanitary waste and having the capacity to serve fewer than 20 persons a day are excluded from the UIC requirements (40 CFR 144.81(9)).

- ✓ Not applicable; this permit does not authorize subsurface wastewater systems or other underground injection. These activities must be assessed under an application for a site specific permit. Certain discharges of stormwater into sinkholes may qualify as UIC. It is important the permittee evaluate all stormwater basins, even those holding water; as sinkholes have varying seepage rates. This permit does not allow stormwater discharges into sinkholes. The facility must ensure sinkholes are avoided in the construction process. The State's online mapping resource <https://modnr.maps.arcgis.com/apps/webappviewer/index.html?id=87ebef4af15d438ca658ce0b2bbc862e> has a sinkhole layer.

VARIANCE:

Per the Missouri Clean Water Law Section 644.061.4, variances shall be granted for such period of time and under such terms and conditions as shall be specified by the commission in its order. The variance may be extended by affirmative action of the commission. In no event shall the variance be granted for a period of time greater than is reasonably necessary for complying with the Missouri Clean Water Law Section 644.006 to 644.141 or any standard, rule, or regulation promulgated pursuant to Missouri Clean Water Law Section 644.006 to 644.141.

- ✓ Not Applicable: This permit is not drafted under premises of a petition for variance.

WASTELOAD ALLOCATIONS (WLA) FOR LIMITATIONS:

Per 10 CSR 20-2.010(78), the amount of pollutant each discharger is allowed by the Department to release into a given stream after the Department has determined total amount of pollutant which may be discharged into the stream without endangering its water quality. Water quality based maximum daily and average monthly effluent limitations were calculated using methods and procedures

outlined in USEPA's Technical Support Document For Water Quality-based Toxics Control (TSD) (EPA/505/2-90-001).

✓ Not applicable; water quality limitations were not applied in this permit.

WATER QUALITY STANDARDS:

Per 10 CSR 20-7.031(4), General Criteria shall be applicable to all waters of the state at all times, including mixing zones.

Additionally, 40 CFR 122.44(d)(1) directs the Department to include in each NPDES permit conditions to achieve water quality established under Section 303 of the CWA, including state narrative criteria for water quality.

WHOLE EFFLUENT TOXICITY (WET) TEST:

Per 10 CSR 20-7.031(1)(FF), a toxicity test conducted under specified laboratory conditions on specific indicator organism; and per 40 CFR 122.2, the aggregate toxic effect of an effluent measured directly by a toxicity test. A WET test is a quantifiable method of determining if a discharge from a facility may be causing toxicity to aquatic life by itself, in combination with, or through synergistic responses when mixed with receiving water.

✓ Not applicable: At this time, permittees are not required to conduct a WET test. This permit is for stormwater only.

PART IV – EFFLUENT LIMITATIONS DETERMINATION

EPA Construction General Permit (CGP)

The CGP was used to research and support best professional judgment decisions made in establishing technology-based conditions for this general permit which are consistent with national standards. The permit writer determined the standards established by the CGP are achievable and consistent with federal regulations. Additionally, the conditions reflecting the best practicable technology currently available are utilized to implement the ELG.

In this general permit, technology-based effluent conditions are established through the SWPPP and BMP requirements. Effective BMPs should be designed on a site-specific basis. The implementation of inspections provides a tool for each facility to evaluate the effectiveness of BMPs to ensure protection of water quality. Any flow through an outfall is considered a discharge. Future permit action due to permit modification may contain new operating permit terms and conditions which supersede the terms and conditions, including effluent limitations, of this operating permit.

PART V – REPORTING REQUIREMENTS

SAMPLING:

The permittee is not required to sample stormwater under this permit. The Department may require sampling and reporting as a result of illegal discharges, compliance issues related to water quality concerns or BMP effectiveness, or evidence of off-site impacts from activities at the facility. If such an action is needed, the Department will specify in writing the sampling requirements, including such information as location and extent. If the permittee refuses to perform sampling when required, the Department may terminate the general permit and require the facility to obtain a site-specific permit with sampling requirements.

REPORTING:

There are no reporting requirements for MO-RAxxxxx land disturbance permits. Land disturbance information is best reviewed on an as requested basis and this permit established documents requirements that allow the Department to request and receive needed documentation prior to, during, or after site inspections.

PART VI – RAINFALL VALUES FOR MISSOURI & SURFACE WATER BUFFER ZONES

Knowledge of the 2-year, 24-hour storm event is used in this permit for two main reasons:

1) The design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. These erosion and sediment controls must be designed to capture or treat a 2-year, 24-hour storm event. This includes BMPs and, depending on the acreage of the drainage area, sediment basins.

2) If the seven-day inspection frequency is utilized, an inspection must occur within 48 hours after any storm event equal to or greater than a 2-year, 24 hour storm has ceased.

A 2-year, 24-hour storm event may be determined in two different ways. For site-specific 2-year, 24-hour storm event information utilize the National Oceanic and Atmospheric Administration's National Weather Service Atlas 14 (NOAA Atlas 14) which is located at https://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html. This is the most accurate and preferred method for determining the 2-

year, 24-hour storm event. In general, this will be the least stringent method. For more information visit;
https://www.weather.gov/media/owp/oh/hdsc/docs/Atlas14_Volume8.pdf.

As an alternative to NOAA Atlas 14, a default value may be utilized. The map below provided by the Department represent the most conservative, protective values for default values applicable to Missouri. In general, this will be the most stringent method. This map is based on Technical Paper No. 40 (TP-40). TP-40 provides a map of the continental U.S. for the 2-year, 24-hour storm event. See map below for default values.

Map 1: Default Values for 2-Year, 24-Hour Storm Event for Design of Sediment and Erosion Controls

Legend: Northern Counties (blue): 3.5 inches
Southern Counties (grey): 4 inches



Surface Water Buffer Zones: In order to design controls that match the sediment removal efficiency of a 50-foot buffer, you first need to know what this efficiency is for your site. The sediment removal efficiencies of natural buffers vary according to a number of site-specific factors, including precipitation, soil type, land cover, slope length, width, steepness, and the types of erosion and sediment controls used to reduce the discharge of sediment prior to the buffer. For additional information;
https://www.epa.gov/sites/default/files/2017-02/documents/2017_cgp_final_appendix_g_-_buffer_reqs_508.pdf

PART VII – ADMINISTRATIVE REQUIREMENTS

On the basis of preliminary staff review and applicable standards and regulations, the Department, as administrative agent for the Missouri Clean Water Commission, proposes to issue a permit(s) subject to certain effluent limitations, schedules, and special conditions contained herein and within the permit. The proposed determinations are tentative pending public comment.

PUBLIC MEETING:

The Department hosted three public meetings for this permit. The meetings were held on January 27, February 17, and March 9, 2021.

PUBLIC NOTICE:

The Department shall give public notice when a draft permit has been prepared and its issuance is pending. Additionally, public notice will be issued if a public hearing is to be held because of a significant degree of interest or because of water quality concerns related to a draft permit. No public notice is required when a request for a permit modification or termination is denied; however, the requester and facility must be notified of the denial in writing.

The Department must give public notice of a pending permit or of a new or reissued Missouri State Operating Permit. The public comment period is a length of time not less than thirty (30) days following the date of the public notice, during which interested persons may submit written comments about the proposed permit.

For persons wanting to submit comments regarding this proposed permit, please refer to the Public Notice page located at the front of this draft permit. The Public Notice page gives direction on how and where to submit appropriate comments.

- ✓ The Public Notice period for this permit was held from November 5, 2021 and ends December 6, 2021. Two letters were received during the 30 day Public Notice period. The summarized comments from the letter and the Department's responses to the comments are below and are in reference to the Public Noticed version of this permit. The comments and responses to the Public Notice of this permit do not warrant the modification of the terms and conditions of this permit.

Letter 1:

Comment #1: Numbering on Page 3 - **there are two #2's**

Response: Thank you, this was corrected.

Comment #2: 2. ... If an individual proposes to develop a lot to reside on (**themselves**),

Response: This word has been added to add clarity.

Comment #3: Table on Page 3, I. Applicability Section A, #2. The second row, second column is confusing. This second part seems to imply that lots less than 1 acre but not part of a common plan would need a permit if the lot is to be sold. This seems contrary to the one or more acres required for a permit.

Response: The second part was reworded in effort to clarify. The "or if" was changed to "including" to clarify both situations are part of the common plan and would require a permit.

Comment #4: The first part of this section before the semicolon seems incomplete:

Response: The redundant wording was removed to clarify this condition.

Comment #5: There is no #3.

Response: Thank you, this was corrected.

Comment #6: Number 4. Could the impaired water also be on the 303(d) list? Impaired waters are only on the 305(b) list after they have a TMDL written. What about the streams on the 303(d) list that are waiting for a TMDL?

Response: The 303(d) list is a less-encompassing component of the all-encompassing 305(b) Report. The permit has been edited to state "designated in the 305(b) Report, including the 303(d) list," to emphasizing the 303(d) list.

Comment #7: 10. Change the word States to state

Response: This was corrected.

Comment #8: There are 2 (b)s under #1. 1(c). Part VII. should be Part VIII STANDARD PERMIT CONDITIONS 6. Replace the period with a colon after BMPs. "The permittee shall select, install, use, operate and maintain appropriate BMPs for the permitted site. The following manuals are acceptable resources for the selection of appropriate BMPs:"

Response: These corrections were made.

Comment #9: 11(b) 2 and 3. These are missing periods after the word "holiday"

Response: These corrections were made.

Comment #10: V. BMP Requirements (2) Can you define "dripline"

Response: A longer explanation of "dripline" was added to that condition for clarity.

Comment #11: 11.(c)(2) Is this missing a word after "from". In the phrase "discharge points from" ? Perhaps just remove the word "from". The phrase would read "inlets, outlets, and discharge points shall be utilized."

Response: This correction has been made.

Comment #12: Also, the addition of language related to BMPs discussed on page 5 and 6 of the fact sheet are positive additions to the permit and should help guide protection of waters of the state from sediment.

On the top of page 6 of the fact sheet, it appears there is a typo: " Migration of soil or product from mis-managed **plies**"

Response: This correction has been made.

Letter 2:

Comment #1: Define Outfalls.

Response: Outfalls are points with discharges of stormwater from areas associated with the industrial activity for which the facility is permitted; in this case construction. Discerning if certain drains which leave the site would be considered an outfall or not would be specific to each site, in addition to the specific phase of construction. Outfalls on construction sites are often not stationary. An outfall does not need to be a pipe, it can be a ditch, channel, or other conduit that discharges stormwater off the property, and there is no size constraint to outfalls. A definition has been added to the fact sheet to add clarification.

Comment #2: I. Applicability: A. Permit Coverage and Authorized Discharges – Permit numbering is off.

Response: Thank you, this has been corrected.

Comment #3: I. Applicability: B. Permit Restrictions – Permit numbering is off.

Response: Thank you, this has been corrected.

Comment #4: 4(c) Discharges from dewatering of sedimentation basins is prohibited. Does this mean direct dumping of dewatering material? Are dewatering controls such as sediment bags, infiltration trenches, or buffer strips allowed?

Response: The definition of no-discharge facility found in 10 CSR 20-6.015 includes the condition "To hold or irrigate, or otherwise dispose without discharge to surface or subsurface waters of the state, all process wastes and associated storm water flows except for discharges that are caused by catastrophic and chronic storm events;". Dewatering controls are allowed so long as they are operated so that the dewatered material and water is not discharged to waters of the state.

Comment #5: 4(c) references 10 CSR 20-6.15(1)B(7). Should this be 10 CSR 20-6.015(1)B(7)?

Response: This has been corrected, thank you.

Comment #6: Could the department please clarify what is meant by a "catastrophic event" referenced in this regulation? The

permit design standards are for the 2-year, 24-hour storm.

Response: Catastrophic storm is defined in 10 CSR 20-6.015(1)(B)2 as “A precipitation event of twenty-four (24)-hour duration or less that exceeds the twenty-five (25)-year, twenty-four (24)-hour storm event.” A chronic storm event is defined in 10 CSR 20-6.015(1)(B)3 as “A precipitation event with a duration of more than twenty-four (24) hours that exceeds the one-in-ten (1 in 10)-year return frequency.”

This information is found on the National Oceanic and Atmospheric Administration’s National Weather Service Atlas 14. A link can be found in the permit part **III. REQUIREMENTS** 4.

Comment #7: IV. SWPPP Management Requirements 1. Multilevel numbering is off.

Response: This has been corrected, thank you.

Comment #8: VIII. Standard Permit Conditions 2. Land Ownership and Change of Ownership 2(c) – Please clarify if an individual needs a land disturbance permit for their personal residence if the portion of land sold is equal to or greater than one acre, as it states in the proposed permit, or only if they will be disturbing one acre or greater.

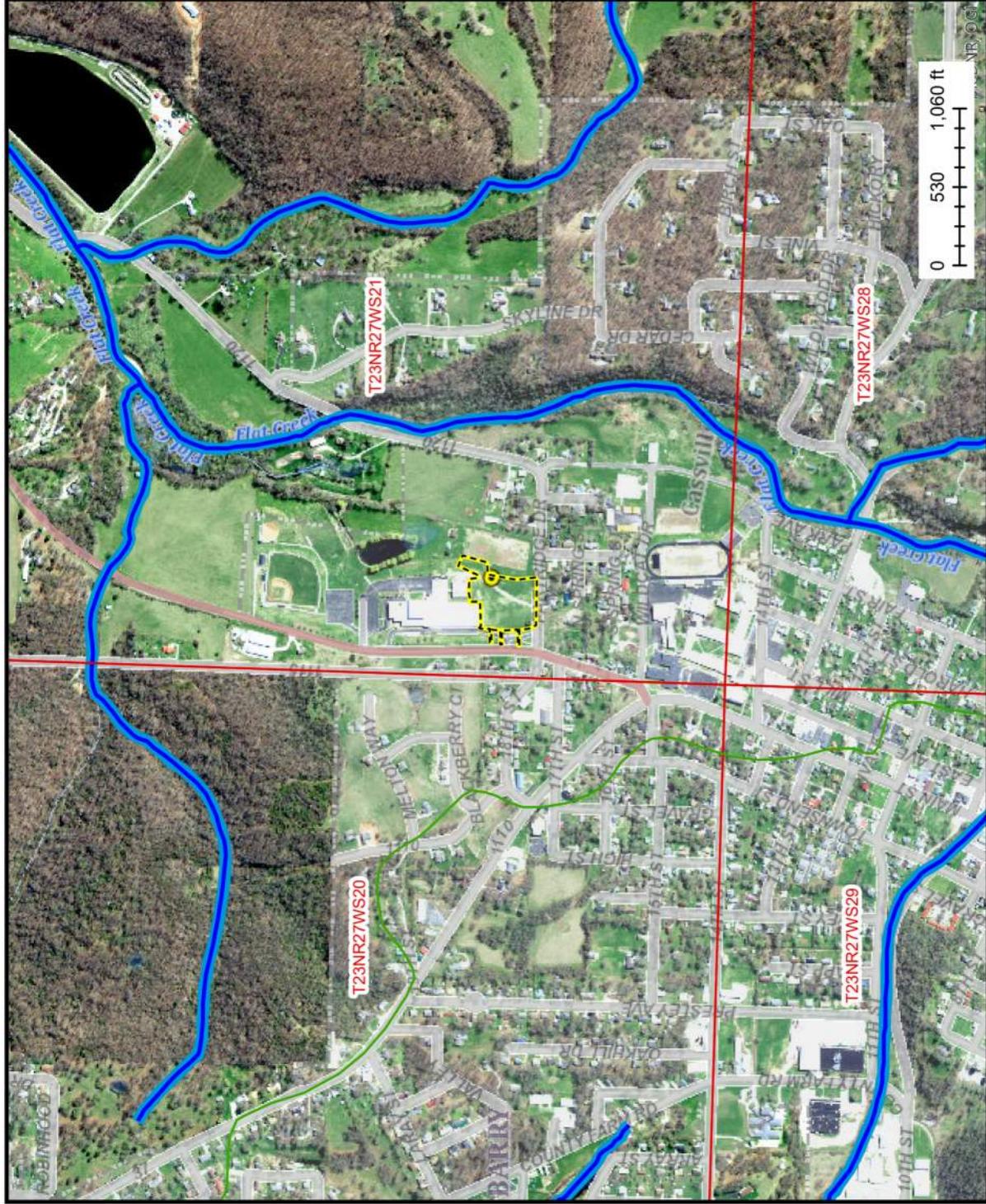
Response: The word ‘disturbed’ has been included in this portion to add clarity.

DATE OF FACT SHEET: 10/13/2021

COMPLETED BY:

SARAH WRIGHT
ENVIRONMENTAL SPECIALIST
MISSOURI DEPARTMENT OF NATURAL RESOURCES
WATER PROTECTION PROGRAM
OPERATING PERMITS SECTION - STORMWATER AND CERTIFICATION UNIT
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Sarah.wright@dnr.mo.gov, dnr.generalpermits@dnr.mo.gov

DNR_Landscape



Legend

- Land Disturbance Point
- Land Disturbance Area
- 12 Digit Watershed Boundaries
- Impaired Streams - 303(d)
- Impaired Lakes - 303(d)
- Stream Classifications and Use Designations
- Lake Classifications and Use Designations
- Public Land Survey System
- Interstates and U.S. highways
- State numbered routes
- State lettered routes
- ramps
- Major roads
- Minor roads
- Railroads
- County Boundaries
- Lake or Pond
- Lake or Pond / Intermittent
- Lake or Pond / Perennial
- Reservoir
- Swamp or Marsh
- Other, Artificial Path
- Canal or Ditch
- Stream or River
- Stream or River / Intermittent
- Stream or River / Perennial
- Municipalities Boundary
- Municipalities Fill

Printed: May 16, 2023

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STORMWATER DISCHARGES FROM
THIS LAND DISTURBANCE SITE ARE
AUTHORIZED BY THE MISSOURI
STATE OPERATING PERMIT NUMBER:

ANYONE WITH QUESTIONS OR
CONCERNS ABOUT STORMWATER
DISCHARGES FROM THIS SITE,
PLEASE CONTACT THE MISSOURI
DEPARTMENT OF NATURAL
RESOURCES AT

1-800-361-4827



MISSOURI DEPARTMENT OF NATURAL RESOURCES

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 Lee's Summit, MO 64086-4710
 816-251-0700 FAX: 816-622-7044

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SECTION 3

SWPPP Narrative

SWPPP NARRATIVE CONTENTS

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1.0. PROJECT CONTACT INFORMATION

Parties directly related to the compliance of the site are listed below. Any blank contacts were not known at the time of SWPPP creation and should be filled in when contractors are assigned.

Should any of the above personnel change, tables will be updated and noted on the Amendment Log found in Section 7 and additional Contractor Certification Sheets will be added to Section 1 of this SWPPP.

Owner/Operator		
Name: Merlyn Johnson	Title: Superintendent	
Company: Cassville R-IV School District		
Address: 1825 State Highway Y		
City: Cassville	State: MO	ZIP Code: 65625
Email address:	Telephone Number: (417)847-2221	

Operator/General Contractor		
Name:	Title:	
Company:		
Address:		
City:	State:	ZIP Code:
Email address:	Telephone Number:	

SWPPP Preparer		
Name: Brock Stringer	Title: Engineer	
Company: Olsson		
Address: 550 E. St. Louis St.		
City: Springfield	State: MO	ZIP Code: 65806
Email address: bstringer@olsson.com	Telephone Number: 417.890.8802	

Permittee Designated Environmental Lead		
Name:	Title:	
Company:		
Address:		
City:	State:	ZIP Code:
Email address:	Telephone Number:	

SWPPP Inspector		
Name:	Title:	
Company:		
Address:		
City:	State:	ZIP Code:
Email address:	Telephone Number:	

Best Management Practice (BMP) Installer		
Name:	Title:	
Company:		
Address:		
City:	State:	ZIP Code:
Email address:	Telephone Number:	

Best Management Practice (BMP) Maintenance		
Name:	Title:	
Company:		
Address:		
City:	State:	ZIP Code:
Email address:	Telephone Number:	

2.0. INTRODUCTION AND DEFINITIONS

This document was created to comply with the Missouri State Operating Permit (MO-RA) in compliance with the Missouri Clean Water Law (Chapter 644 R.S. Mo. as amended) and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress). Relevant local ordinances are incorporated in Section 8 of this SWPPP. Permit language incorporated into this document will be denoted by *italics*.

The purpose of the SWPPP is to ensure the design, implementation, management, and maintenance of best management practices (BMPs) in order to prevent sediment and other pollutants in stormwater discharges associated with the land disturbance activities; compliance with the Missouri Water Quality Standards; and compliance with the terms and conditions of the general permit.

2.1. ACRONYMS

AST.....	aboveground storage tank
BMP.....	best management practice
MDNR.....	Missouri Department of Natural Resources
ESA.....	environmental site assessment
ESC.....	erosion and sediment control
MO-RA.....	Missouri State Operating Permit
MS4.....	municipal separate storm sewer system
NRC.....	National Response Center
NRCS.....	Natural Resources Conservation Service
REC.....	recognized environmental condition
SPCC.....	spill prevention control and countermeasures plan
SVOC.....	semivolatile organic compound
SWPPP.....	stormwater pollution prevention plan
TMDL.....	total maximum daily load
TOC.....	total organic carbon
USEPA.....	United States Environmental Protection Agency
VOC.....	volatile organic compound
WSS.....	Web Soil Survey

2.2. DEFINITIONS

Common Promotional Plan

A plan undertaken by one (1) or more persons to offer lots for sale or lease; where land is offered for sale by a person or group of persons acting in concert, and the land is contiguous or is known, designated, or advertised as a common unit or by a common name or similar names,

the land is presumed, without regard to the number of lots covered by each individual offering, as being offered for sale or lease as part of a common promotional plan.

Department

Missouri Department of Natural Resources

Immediately

For the purposes of this permit, immediately should be defined as within 24 hours.

Larger Common Plan of Development or Sale:

A continuous area where multiple separate and distinct construction activities are occurring under one plan, including any offsite borrow areas that are directly and exclusively related to the land disturbance activity. Off-site borrow areas utilized for multiple different land disturbance projects are considered their own entity and are not part of the larger common plan of development or sale. See definition of Common Promotional Plan to understand what a 'common plan' is.

Minimize

To reduce and/or eliminate to the extent achievable using stormwater controls that are technologically available and economically practicable and achievable in light of best industry practices.

Qualified Person (inspections)

A person knowledgeable in the principles and practice of erosion and sediment controls and pollution prevention who possesses the appropriate skills and training to assess conditions at the construction site that could impact stormwater quality and the appropriate skills and training to assess the effectiveness of any stormwater controls selected and installed to meet the requirements of this permit.

Volunteer Vegetation

A volunteer plant is a plant that grows on its own, rather than being deliberately planted for stabilization purposes. Volunteers often grow from seeds that float in on the wind, are dropped by birds, or are inadvertently mixed into soils. Commonly, volunteer vegetation is referred to as 'weeds'. This does not meet the requirements for final stabilization.

Waters of the State

Section 644.016.1(27) RSMo. defines waters of the state as, "All waters within the jurisdiction of this state, including all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two or more persons jointly or as tenants in common."

3.0. SITE DESCRIPTION

Project Name: Cassville High School Performing Arts Center

Project Location: 1825 St. Hwy. Y, Cassville, MO 65625

Total project area: 40 ± Ac.

Area to be disturbed: 4.25 ± Ac.

Anticipated start date: July 2023

Anticipated end date: July 2024

Historic Preservation Information: There are no federal government obligations, including permit requirements, funding, or land ownership (including Native American Tribal Lands) associated with this site. Therefore, compliance with section 106 of the National Historic Preservation Act of 1966 (NHPA-36 CFR Part 800) is not necessary for this site.

Endangered Species Information: According to correspondence with the Missouri Department of Conservation's Natural Heritage Review and an inquiry with the U.S. Fish and Wildlife Information, Planning, and Conservation (IPaC) the following information related to the project site was found:

Species habitats that may or may not be impacted by the construction activities onsite:

- Gray Bat
- Indiana Bat
- Northern Long-eared Bat
- Ozark Big-eared Bat
- Tricolored Bat
- Ozark Cavefish
- Monarch Butterfly

Refer to Section 10.0 of this SWPPP binder for additional information and documentation.

Existing conditions: The existing site consists of the existing Cassville High School, sports fields, parking lots, and detention basin. The southern boundary of the site is adjacent to Partridge Dr., the western boundary is adjacent to State Hwy. Y, the eastern boundary is adjacent to existing fields and mobile homes, and the northern boundary is adjacent to existing fields. The site is primarily comprised of Pomme silt loam, Noark very gravelly silt loam, and Secesh silt loam. Refer to the soils map in SWPPP binder Section 4 for additional information about the location and types of soils. In the existing condition, the majority of the site discharges into the existing detention basin on the east side of the site. The southern portion of the site discharges to an existing drainage ditch along Partridge Dr. and continues to Flat Creek.

Description of construction activity: This project includes the construction of the new Cassville High School Performing Arts Center and detention basin on the southern portion of the site. This includes but is not limited to grading activities, building construction, parking construction, utility construction, and erosion control measures. New storm sewer inlets, pipes, and roof drains will collect runoff from the parking area and the roof, and a small portion of the site will continue to drain along Partridge Rd. The runoff will discharge into the new detention basin and will continue to discharge into the existing detention basin. All other sources of runoff from other portions of the site will continue to discharge as it does in the existing condition.

Table 1. Anticipated Sequence of Construction.

(insert phasing chart from plans or include narrative description of sequence)

Location of nearby or on-site surface waters: The existing detention basin permanently retains some water, but is not within 50' of anticipated grading activities.

Table 2. Outfalls.

#	Type	Location	Drainage Area
1	Stormwater Detention Basin	East Edge of Property	8.40 Ac.

Receiving Waters: The receiving water for the project site is the existing detention basin to Flat Creek. According to the Impaired Waters and Total Maximum Daily Loads (TMDL) Viewer, there appears to be no impairment at the time of inquiry.

4.0. EROSION AND SEDIMENT CONTROLS

Temporary BMPs used during active construction of the project will be listed below. Specific erosion and sediment control requirements found in the permit are also located here and should be addressed in the erosion and sediment control (ESC) plan sheets located in Section 5 of this SWPPP.

Table 3. Anticipated BMPs.

BMP	
Site Preparation	
SWPPP Sign	<input checked="" type="checkbox"/>
Construction exit	<input checked="" type="checkbox"/>
Wash rack	<input type="checkbox"/>
Temporary stream crossing	<input type="checkbox"/>
Surface roughening	<input type="checkbox"/>
Tree protection	<input type="checkbox"/>
Erosion Control	
Dust control	<input checked="" type="checkbox"/>
Mulch	<input checked="" type="checkbox"/>
Erosion control blankets	<input checked="" type="checkbox"/>
Temporary seeding	<input checked="" type="checkbox"/>
Permanent seeding	<input checked="" type="checkbox"/>
Hydroseeding	<input checked="" type="checkbox"/>
Sodding	<input type="checkbox"/>
Slope protection	<input checked="" type="checkbox"/>

BMP	
Sediment Control	
Silt fence	<input checked="" type="checkbox"/>
Inlet protection	<input checked="" type="checkbox"/>
Diversion berm	<input type="checkbox"/>
Filter berm	<input type="checkbox"/>
Outlet protection	<input checked="" type="checkbox"/>
Check dam	<input checked="" type="checkbox"/>
Sediment trap	<input type="checkbox"/>
Sediment basin	<input type="checkbox"/>
Pollution Prevention	
Stockpile	<input checked="" type="checkbox"/>
Concrete washout	<input checked="" type="checkbox"/>
Solid waste management	<input checked="" type="checkbox"/>
Sanitary waste management	<input checked="" type="checkbox"/>
Material staging areas	<input checked="" type="checkbox"/>
	<input type="checkbox"/>

Specification and detail sheets can be found in Section 6 of this SWPPP.

During construction, if additional BMPs not listed in Table 3 are required, the SWPPP will be amended. The BMP specification and detail sheets of the new BMPs should be added to Section 6 of this SWPPP, the locations noted on the BMP Tracking Map located in Section 5, and the change noted in the Log of Amendments located in Section 7 of this SWPPP.

4.1. EROSION AND SEDIMENT CONTROL DESIGN REQUIREMENTS

ESC plans for the project can be found in Section 5 of this SWPPP. Excerpts of these plans will be used as the basis of the BMP Tracking Map located in Section 5 of this SWPPP.

Ensure the design, installation, and maintenance of effective erosion and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed, and maintained to:

- a. Control stormwater volume, velocity, and peak flow rates within the site to minimize soil erosion;*
- b. Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and stream bank erosion and scour;*
- c. Minimize the amount of exposed soil during construction activity;*
- d. Minimize the disturbance of steep slopes;*
- e. Minimize sediment discharges from the site. Address factors such as:
 - 1) the amount, frequency, intensity, and duration of precipitation;*
 - 2) the nature of resulting stormwater runoff;*
 - 3) expected flow from impervious surfaces, slopes, and drainage features; and*
 - 4) soil characteristics, including the range of soil particle size expected to be present on the site;**
- f. Provide and maintain natural buffers around surface waters as detailed in Part V. BMP REQUIREMENTS Condition 7, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration and filtering, unless infeasible;*
- g. Minimize soil compaction and preserve topsoil where practicable; and*
- h. Capture or treat a 2-year, 24-hour storm event (MDNR 2022).*

4.2. TREE AND VEGETATION PRESERVATION

When applicable, areas where existing trees and vegetation are preserved on-site can be found on the ESC plan sheets located in Section 5 of this SWPPP.

4.3. NATURAL BUFFERS

When applicable, natural buffers will be identified on the ESC plans located in Section 5 of this SWPPP.

For surface waters of the state, defined in Section 644.016.1(27) RSMo, located on or adjacent to the site, the permittee must maintain a riparian buffer or structural equivalent in accordance with at least one of the following options. The selection and location must be described in the SWPPP.

- a. Provide and maintain a 50-foot undisturbed natural buffer; or*
- b. Provide and maintain an undisturbed natural buffer that is less than 50 feet and is supplemented by erosion and sediment controls that achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer; or*

- c. *If infeasible to provide and maintain an undisturbed natural buffer of any size, implement erosion and sediment controls to achieve the sediment load reduction equivalent to a 50-foot undisturbed natural buffer.*
- d. *The permittee is not required to comply with (a), (b), or (c) above if one or more of the following exceptions apply and documentation is provided in the SWPPP:*
 - i. *If there is no discharge of stormwater to waters of the state through the area between the disturbed portions of the site and waters of the state located within 50 feet of the site. This includes situations where the permittee has implemented permanent control measures that will prevent such discharges, such as a berm or other barrier.*
 - ii. *Where no natural buffer exists due to preexisting development disturbances that occurred prior to the initiation of planning for the current development of the site.*
 - a. *Where some natural buffer exists but portions of the area within 50 feet of the waters of the state are occupied by preexisting development disturbances the permittee is required to comply with (a), (b), or (c) above.*
 - iii. *For linear projects where site constraints make it infeasible to implement a buffer or equivalent provided the permittee limit disturbances within 50 feet of any waters of the state and/or the permittee provides supplemental erosion and sediment controls to treat stormwater discharges from earth disturbances within 50 feet of the water of the state. The permittee must also document in the SWPPP the rationale for why it is infeasible for the permittee to implement (a), (b), or (c) and describe any buffer width retained and supplemental BMPs installed.*
- e. *Where the permittee is retaining a buffer of any size, the buffer should be measured perpendicularly from any of the following points, whichever is further landward from the water:*
 - 1) *The ordinary high water mark of the water body, defined as the line on the shore established by fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, and/or the presence of litter and debris; or*
 - 2) *The edge of the stream or river bank, bluff, or cliff, whichever is applicable. (MDNR 2022).*

4.4. STABILIZATION REQUIREMENTS

The permit requires specific stabilization schedules depending on activity level and slope characteristics.

Soil disturbing activities on site that have ceased either temporarily or permanently shall initiate stabilization immediately in accordance with the options below. For soil disturbing activities that

have been temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days:

(a) The permittee shall construct BMPs to establish interim stabilization; and

(b) Stabilization must be initiated immediately and completed within 14 calendar days.

(c) For soil disturbing activities that have been permanently ceased on any portion of the site, final stabilization of disturbed areas must be initiated immediately and completed within 14 calendar days.

1) Extension to the 14-day completion period for temporary and final stabilization may be made due to weather and equipment malfunctions. In these circumstances, the justification for the extension to the 14 day shall be documented in the SWPPP. The discontinuation or continuation of the extension may be determined by review of the Department staff when on site.

(d) Until stabilization is complete, interim sediment control shall consist of well-established and maintained BMPs that are reasonably certain to protect waters of the state from sediment pollution over an extended period of time. This may require adding more BMPs to an area than is normally used during daily operations. The types of BMPs used must be suited to the area disturbed, taking into account the number of acres exposed and the steepness of the slopes. If the slope of the area is greater than 3:1 (three feet horizontal to one foot vertical) or if the slope is greater than 3% and greater than 150 feet in length, then the permittee shall establish interim stabilization within seven days of ceasing operations on that part of the site. The following activities would constitute the immediate initiation of stabilization:

1) Prepping the soil for vegetative or non-vegetative stabilization as long as seeding, planting, and/or installation of non-vegetative stabilization products takes place as soon as practicable;

2) Applying mulch or other non-vegetative product to the exposed areas;

3) Seeding or planting the exposed areas;

4) Finalizing arrangements to have stabilization product fully installed in compliance with the deadlines for completing stabilization.

(e) If vegetative stabilization measures are being implemented, stabilization is considered "installed" when all activities necessary to seed or plant the area are completed. Installed does not mean established (MDNR 2022).

5.0. STORMWATER MANAGEMENT CONTROLS

When applicable, permanent stormwater management BMPs will be listed and described here. Design specifications and details can be found in Section 6 of this SWPPP if applicable. These BMPs will remain in place to provide for stormwater management after construction has completed and the permit terminated.

Table 4. Post Construction Stormwater Management BMPs.

Type	Location	Receiving Water	Area Treated
Detention Basin	East Side of Property	Existing Detention Basin to Flat Creek	8.40 Ac.

6.0. POLLUTION PREVENTION AND SPILL REPORTING

Good housekeeping practices shall be maintained at all times to keep waste from entering waters of the state. Below is a list of authorized non-stormwater discharges, and potential pollutants that will likely be on-site during construction. Suggested BMPs to help resolve potential discharges from non-stormwater discharges as well as potential pollutants are discussed.

6.1. GOOD HOUSEKEEPING

Good housekeeping practices shall be maintained at all times to keep waste from entering waters of the state.

- (a) Provide solid and hazardous waste management practices, including providing trash containers, regular site cleanup for proper disposal of solid waste such as scrap building material, product/material shipping waste, food/beverage containers, spent structural BMPs;*
- (b) Provide containers and methods for proper disposal of waste paints, solvents, and cleaning compounds.*
- (c) Manage sanitary waste. Portable toilets shall be positioned so that they are secure and will not be tipped or knocked over and so that they are located away from waters of the state and stormwater inlets and stormwater conveyances.*
- (d) Ensure the storage of construction materials be kept away from drainage courses, stormwater conveyances, storm drain inlets, and low areas (MDNR 2022).*

6.2. AUTHORIZED NON-STORMWATER DISCHARGES

The below signified discharges are anticipated to occur on-site.

- Discharges from emergency fire-fighting activities;
- De-chlorinated fire hydrant flushing;
- Uncontaminated water line flushing;
- Uncontaminated condensate from air conditioning or compressor condensate;
- Landscape watering;
- Uncontaminated, non-turbid discharges of ground water or spring water;
- Foundation or footing drains where flows are not contaminated with process materials;
- Water used to control dust; and
- Pavement wash waters, provided spills or leaks of toxic or hazardous substances have not occurred (unless all spill material has been removed) and where soaps, solvents, and detergents are not used. Directing pavement wash waters directly into any water of the state, storm inlet, or stormwater conveyance, unless the conveyance is connected to an effective control, is prohibited.

Potential BMPs used for authorized non-stormwater discharges:

6.3. POTENTIAL POLLUTANTS

Potential pollutant sources that are anticipated to be on-site during the project can be found in the table below.

Table 5. Anticipated Potential Pollutants.

The below listed suggested BMPs are meant as initial examples and should be adjusted as site conditions necessitate different BMPs. The table should be amended should additional pollutants and BMPs be utilized onsite that were not originally anticipated.

Material/Activity	Potential Pollutants	Suggested BMPs
Concrete Curing Substances	Sediment, metals, hydrocarbons	<p>Provide secondary containment in preparation and cleanup areas.</p> <p>Leftover curing substances should to be removed from the site or disposed of in a designated washout bin or pit designed to contain curing substances.</p> <p>Do not use materials during or directly prior to an anticipated rain event, and ensure excess materials are stored in a covered area to minimize contact with stormwater.</p> <p>Curing compounds should not be washed into a gutter, onto the ground, or into a storm drain inlet.</p>
Concrete Washwater and Masonry Washwater	pH, heavy metals, silica	<p>Concrete washwater will be controlled /contained at a designated location on-site such as a leak-proof container or settling basin of adequate size.</p> <p>Refer to Concrete Washout Specification located in Section 6 of this SWPPP for proper design criteria and use of concrete washout area.</p> <p>The concrete washout area should be cleaned out when it has reached 75% capacity, and dried concrete material should be disposed of in accordance with state and local regulations.</p>
Detergents	pH, chlorine, surfactant	<p>Use of detergents on-site should be discouraged.</p> <p>Washing of vehicles or equipment that requires the use of detergents should occur off-site.</p>
Drywall and Joint Compound	Vinyl acetate, acetaldehyde, calcium sulfate dehydrate, formaldehyde, silica	<p>Drywall and joint compound will be used on the interior of structures.</p> <p>Ideally these materials should be stored inside the structure out of contact of stormwater.</p> <p>If storage inside the structure is not practical, the materials should be placed in a storage container, contractor vehicle, or trailer or otherwise covered to minimize contact with stormwater.</p>

		<p>Waste products can be disposed of with construction debris as soon as possible and should not be allowed to accumulate on lots.</p>
Fertilizers	Nutrients	<p>Fertilizers can be kept on-site in amounts necessary for immediate use.</p> <p>In the event fertilizers must remain on-site longer, they should be stored in a covered area to minimize contact with precipitation.</p> <p>Refer to the manufacturer's recommendations for application and disposal.</p> <p>Do not over apply or apply before an anticipated runoff-producing rain event.</p>
Form Release Oil	Petroleum hydrocarbons	<p>Do not remove the original product label from container.</p> <p>Store containers in a covered area or in contractor vehicles to minimize contact with stormwater.</p> <p>Follow the manufacturer's recommended usage instructions.</p> <p>Do not use before or during any precipitation event.</p> <p>Use all of the product before disposing of the container and only place in a waste receptacle designated to receive this type of waste.</p>
Fuels and Oils	Petroleum hydrocarbons and distillates	<p>If aboveground storage tanks (ASTs) are required, locations will be tracked on the SWPPP map.</p> <p>A separate spill prevention containment and countermeasure (SPCC) plan will be developed should one or more of the following be present on-site:</p> <ul style="list-style-type: none"> • A single AST for oil with 660 gallons or more capacity • Two or more ASTs with an aggregate of 1,320 gallons or more capacity (include storage vessels stored above ground with a capacity of 55 gallons or more with the aggregate total capacity) • Belowground oil storage vessels of 42,000 gallons or more <p>Smaller fuel containers and gas-powered equipment should be kept in secondary containment vessels to prevent spills or leaks during fueling and operation. Small gas cans can be kept in the back of trucks when not in use.</p> <p>Drip pans should be used for parked vehicles where leaks have been identified.</p> <p>Soil stained with fuel or other petroleum products should be removed and disposed of in compliance with federal, state, and local requirements.</p>
Grease / Lubricants	Petroleum hydrocarbons	<p>If grease is to be stored on-site, it should be stored in a covered location to minimize contact with stormwater.</p> <p>The application of lubricants should be conducted off-site when possible or in an area with sufficient secondary containment</p>

		<p>measures to contain any leaks or spills. If neither option is practicable, leaks and spills should be contained and cleaned up as soon as practicable to minimize contact with stormwater.</p> <p>Lubricants should not be applied in rain or on exposed areas of machinery when precipitation is expected.</p>
Glue / Adhesives	Organic aromatic compounds, semivolatile organic compounds (SVOC)	<p>Glue and adhesives may be used on-site for construction in interior work.</p> <p>Adhesives should be stored in covered areas and out of contact of precipitation.</p> <p>Materials will be used and disposed of in accordance with manufacturers recommendations.</p> <p>Exterior adhesives should not be applied during or immediately before anticipated precipitation events.</p>
Landscape Materials	Nutrients, sediment, pH	<p>Landscape materials include—but are not limited to—items such as topsoil, compost, mulch, polymers, gypsum, and lime.</p> <p>If the materials are to be stored on-site they should be stored in a covered area or covered with plastic sheeting, tarps, or similar products to minimize contact with stormwater. If the amount of material is too large to be covered the materials should be contained by silt fence, wattles, berms or other sediment control BMPs.</p> <p>Soil amendments should not be used before anticipated runoff producing rain events.</p>
Material Storage	Solid waste, hydrocarbons, nutrients, sediment, hazardous materials	<p>As necessary and as space on the project allows, material storage areas should be dedicated on-site.</p> <p>The number of access points to the material storage area should be limited, and materials should be stored away from drainage courses and low areas.</p> <p>Hazardous materials should be stored in containers or structures or otherwise covered to minimize contact with stormwater. Secondary containment should be provided for the area not only to contain spills but also to limit multiple access points.</p>
Paint	pH, ethylene glycol, titanium oxide, volatile organic compounds (VOC)	<p>Paint washwater should be properly contained on-site in a designated area and handled similarly to concrete washwater.</p> <p>Used materials (i.e., soiled brushes, rollers, sprayers) and dried latex paint should be disposed of in appropriate waste receptacles, preferably off-site.</p> <p>Unused quantities of paint should be removed from site by trades and not disposed of on-site.</p> <p>Any quantities stored on-site should be stored in covered areas to minimize contact with stormwater.</p>
Pesticides, Herbicides	Organophosphates, carbamates, triazines,	<p>Pesticides and herbicides should be used and disposed of per manufacturer's recommendations. Avoid overapplying products</p>

	chloroacetanilides, salts, heavy metals	<p>and avoid applying products before anticipated runoff-producing storm events.</p> <p>Storage of pesticides and herbicides on-site should be discouraged. Should storage on-site be required, items should be stored in covered areas to minimize contact with precipitation and stormwater.</p> <p>Spilled material should be promptly cleaned up per manufacturer's recommendations.</p>
Refrigerants	Various -fluoroethanes and -fluoromethanes	<p>Refrigerants will be used in heating, ventilation, and air-conditioning (HVAC) systems in built structures on-site. Refrigerants should not be stored on-site other than the volume needed for the HVAC systems.</p> <p>Refrigerants will be handled and disposed of by properly trained technicians.</p>
Sanitary Waste	Bacteria, viruses, parasites	<p>Sanitary stations should be located where accidental discharge cannot flow to storm drains, gutters, surface waters, or conveyance channels.</p> <p>Locate stations on a level, permeable surface, away from drainage courses and low areas. These stations should not be located on streets, sidewalks, or on top of inlets.</p> <p>Stations will be inspected and maintained by a qualified person at frequent and regular intervals to assure cleanliness and proper operation.</p>
Sediment / Total Suspended Solids	Turbidity, nutrients	<p>Surface water impairments caused by sediment and total suspended solids will have a higher risk of occurring in areas where soils have been disturbed for construction activities.</p> <p>Temporary controls are described in this SWPPP to control and contain this potential pollutant during land-disturbing activities of the project.</p> <p>Vegetation (temporary or permanent stabilization) is a very efficient BMP for controlling sediment and should be used whenever possible.</p>
Solid Waste	Floatable and blowable trash and debris	<p>Solid waste created from construction activities (including but not limited to scrap building material, product/material shipping waste, food containers, and cups) should be properly contained on-site and removed frequently from the site for disposal.</p> <p>Dumpsters should to be emptied at regular intervals and as needed during times of high activity on the site.</p> <p>Efforts should be taken to minimize exposure of solids wastes generated on the site to stormwater.</p>
Solvents	VOC, SVOC	<p>If solvents are stored on-site, they should be stored in a covered and secured area to prevent spills and minimize contact with stormwater.</p>

		The materials will be used and disposed of per manufacturer's recommendations and federal, state, and local regulations.
		Secondary containment should be provided in mixing and cleanup areas.
		Leftover materials should be removed from the site or disposed of in an area designated to receive this type of waste.
Stains, Stucco, and Associated Materials	Ethylene glycol, SVOC, VOC, silica, pH	Do not use materials during a precipitation event, and ensure all excess materials are stored in a covered area to minimize contact with stormwater.
		Materials should not be washed into a gutter, on the ground, or into a storm drain inlet. If washing on-site, consider using a designated containment bin or pit for washwater.
Vehicle Washing, Wheel Washwater	Sediment, petroleum hydrocarbons, heavy metals	If vehicle washing and/or wheel washing is to occur on-site, it should be done in designated areas where washwater can collect in a basin or alternative control.
		Use of detergents should be discouraged.
		Washing on paved surfaces should be discouraged unless water can be sufficiently treated before leaving the site.

6.4. NONREPORTABLE SPILL PROTOCOL

Most spills can be cleaned up following manufacturer's recommendations. Absorbent materials, sealable containers, plastic bags, and shovels/brooms are suggested as minimum spill response items that should be available at this location.

- Check for hazards (flammable material, noxious fumes). If flammable liquid, turn off engines and nearby electrical equipment. If serious hazards are present, leave the area and call 911.
- Make sure the spill area is safe to enter and that it does not pose an immediate threat to health or safety of any person.
- Stop the spill source.
- Call co-workers and supervisor for assistance and to make them aware of the spill and potential dangers.
- If possible, stop the spill from entering drains (use absorbent or other material as necessary).
- Stop spill from spreading (use absorbent or other material).
- If spilled material has entered a storm sewer, contact the locality at the below number.
- Clean up spilled material according to manufacturer's specifications. For liquid spills, use absorbent material and do not flush the contaminated area with water.
- Properly dispose of cleaning materials and used absorbent material according to manufacturer specifications.

6.5. REPORTABLE SPILLS

Requirements for reporting spills of hazardous materials and typical site pollutants and spill report documentations can be found in Section 9 of this SWPPP.

Spills, Overflows, and Other Unauthorized Discharges.

(a) Any spill, overflow, or other discharge not specifically authorized in the permit above are unauthorized.

(b) Should an unauthorized discharge cause or permit any contaminants to discharge or enter waters of the state, the unauthorized discharge must be reported to the appropriate Regional Office as soon as practicable but no more than 24 hours after the discovery of the discharge. If the spill or overflow needs to be reported after normal business hours or on the weekend, the facility must call the Department’s Environmental Emergency Response hotline at (573) 634-2436. Leaving a message on a Department staff member voice-mail does not satisfy this reporting requirement.

(c) A record of all spills shall be retained with the SWPPP and made available to the Department upon request.

(d) Other spills not reaching waters of the state must be cleaned up as soon as possible to prevent entrainment in stormwater but are not required to be reported to the Department (MDNR 2022).

Table 6. Barry County Health/Environmental Services Contact.

Name/Position	Contact Number
Roger Brock, Administrator	417.847.2114

Report to:	Contact Number
Southwest Regional Office 2040 W. Woodland Springfield, MO 65807-5912	417.891.4300
MDNR 24-Hour Spill Response	573.634.2436
National Response Center (NRC)	800.424.8802

7.0. SWPPP IMPLEMENTATION

7.1. PUBLIC NOTIFICATION

The locations of the site posting will be noted on the site BMP Tracking Map located in Section 5 of this SWPPP. The location will be updated should the posting move.

The permittee shall post a public notification sign at the main entrance to the site with the specific MORA permit number. The public notification sign must be visible from the public road that provides access to the site's main entrance. An alternate location is acceptable provided the public can see it and it is noted in the SWPPP. The public notification sign must remain posted at the site until the permit has been terminated. The sign is provided at the end of this permit (MDNR 2022).

7.2. INSPECTIONS

Site inspections should be conducted by qualified personnel at the frequency indicated below. Site inspection reports can be stored in Section 12 of this SWPPP unless otherwise noted.

All BMPs must be inspected in accordance to one of the schedules listed below. The inspection frequency shall be documented in the SWPPP, and any changes to the frequency of inspections, including switching between the options listed below, must be documented on the inspection form:

- At least once every seven (7) calendar days and within 48 hours after any storm event equal to or greater than a 2-year, 24-hour storm has ceased during a normal work day or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday; or*

- Once every 14 calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches of precipitation or greater, or the occurrence of runoff from snowmelt. To determine if a storm event of 0.25 inches or greater has occurred on the site, the permittee shall either keep a properly maintained rain gauge on site, or obtain the storm event information from a weather station near the site location.*
 - 1) Inspections are only required during the project's normal working hours.*
 - 2) An inspection must be conducted within 24 hours of a storm event which has produced 0.25 inches. The inspection shall be conducted within 24 hours of the event end, or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.*
 - 3) If it is elected to inspect every 14 calendar days and there is a storm event at the site that continues for multiple days, and each day of the storm produces 0.25 inches or more of rain, the permittee shall conduct an inspection within 24 hours of the end of the*

storm or within 72 hours if the rain event ceases during a non-work day such as a weekend or holiday.

- For any portion of the site that discharges within the watershed of an Outstanding National or State Resource Water or a water impaired for sediment, inspections shall be inspected once every seven (7) calendar days and within 24 hours of the occurrence of a storm event of 0.25 inches or greater, or when the occurrence of runoff flow from frozen or snowmelt is sufficient to cause a discharge.*

Areas on-site that have achieved stabilization, while at the same time active construction continues on other areas, may reduce inspection frequency to monthly, for those stabilized areas, if the following conditions exist:

- 1) For areas where disturbed portions have undergone temporary stabilization, inspections shall occur at least once a month while stabilized and when re-disturbed shall follow either frequency outlined in (a),(b), or (c) above.*
- 2) Areas on-site that have achieved final stabilization must be inspected at least once per month until the permit is terminated.*

If construction activities are suspended due to frozen conditions, the permittee may temporarily reduce site inspections to monthly until thawing conditions begin to occur if all of the following are met:

- 1) Land disturbances have been suspended; and*
- 2) All disturbed areas of the site have been stabilized in accordance with Part V. BMP REQUIREMENTS, Condition 13 of the permit.*
- 3) The change shall be noted in the SWPPP (MDNR 2022).*

7.3. CORRECTIVE ACTIONS

Structural or maintenance problems with BMPs used in this project and noted as a result of an inspection shall be corrected as soon as possible but no more than seven calendar days after the inspection.

7.4. MODIFICATION AND AMENDMENTS

Modifications and amendments to the SWPPP can be tracked in Section 7 of this SWPPP. Below are minimum guidelines for when the SWPPP should be updated.

Throughout coverage under this permit, the permittee shall amend and update the SWPPP as appropriate during the term of the land disturbance activity. All SWPPP modifications shall be signed and dated. The permittee shall amend the SWPPP to incorporate any significant site condition changes which impact the nature and condition of stormwater discharges. At a minimum, these changes include whenever the:

- a. Location, design, operation, or maintenance of BMPs is changed;*
- b. Design of the construction project is changed that could significantly affect the quality of the stormwater discharges;*

- c. *Permittee's inspections indicate deficiencies in the SWPPP or any BMP;*
- d. *Department notifies the permittee in writing of deficiencies in the SWPPP;*
- e. *SWPPP is determined to be ineffective in minimizing or controlling erosion and sedimentation (e.g., there is visual evidence of excessive site erosion or sediment deposits in streams, lakes, or downstream waterways, sediment or other wastes offsite); and/or*
- f. *Department determines violations of water quality standards may occur or have occurred (MDNR 2022).*

7.5. TRANSFER OF OWNERSHIP

As necessary, permit transfers or records of sale should be placed in Section 2 of this SWPPP.

This permit may not be transferred to a new owner in any fashion except by submitting an Application for Transfer of Operating Permit signed by the seller and buyer of the site along with the appropriate modification fee. In some cases, revocation and reissuance may be necessary. Facilities that undergo transfers of ownership without notice to the Department are considered to be operating without a permit (MDNR 2022).

7.6. TERMINATION OF PERMIT

When the project is completed and has reached final stabilization, a copy of the notice of termination and confirmation from the MDNR should be placed in Section 14 of this SWPPP.

Until the permittee terminates coverage under this permit, the permittee must comply with all conditions in the permit, including continuation of site inspections and public notification signage posted. To terminate permit coverage, the permittee must submit to the appropriate Regional Office a complete and accurate Request for Termination of Operating Permit which certifies that the site meets the following requirements:

- (a) For any areas that (1) were disturbed during construction, (2) are not covered over by permanent structures, and (3) over which the permittee had control during the construction activities, the requirements for final vegetative or non-vegetative stabilization in Part V BMP REQUIREMENTS, Condition 13 of the permit;*
- (b) The permittee has removed and properly disposed of all construction materials, waste, and waste handling devices and has removed all equipment and vehicles that were used during construction, unless intended for long-term use following termination of permit coverage;*
- (c) The permittee has removed all temporary BMPs that were installed and maintained during construction, except those that are intended for long-term use following termination of permit coverage or those that are biodegradable; and*
- (d) The permittee has removed all potential pollutants and pollutant-generating activities associated with construction, unless needed for long-term use following termination of permit coverage.*

The Department may request photographs that clearly document compliance with termination requirements.

The permit may be terminated if;

(a) There has been a transfer of control of all areas of the site for which the current permittee is responsible under this permit to another operator, and that operator has obtained coverage under this permit; or

(b) Coverage under an individual or alternative general NPDES permit, with land disturbance conditions, has been obtained (MDNR 2022).

7.7. RECORDS

When the project is complete, and the notice of termination has been accepted by the MDNR, records should be removed from the site and retained.

The permittee shall retain copies of this general permit, the SWPPP and all amendments for the site named in the State Operating Permit, results of any monitoring and analysis, and all site inspection records required by this general permit.

(a) The records shall be accessible during normal business hours and retained for a period of at least three (3) years from the date of termination.

(b) The permittee shall provide a copy (electronic or otherwise) of the SWPPP to the Department, USEPA, or any local agency or government representative if they request a copy in the performance of their official duties within 24 hours of the request (or next working day), unless given more time by the representative.

(c) The permittee shall provide a copy of the SWPPP to those who are responsible for installation, operation, or maintenance of any BMP. The permittee, their representative, and/or the contractor(s) responsible for installation, operation and maintenance of the BMPs shall have a current copy of the SWPPP with them when on the project site (MDNR 2022).

8.0. REFERENCES

- California Stormwater Quality Association. (November 2009). *Stormwater Best Management Practice Handbook Portal: Construction*. Retrieved from <http://www.buenapark.com/home/showdocument?id=2557>.
- Missouri Department of Natural Resources. (February 2022). *Missouri State Operating Permit*. Retrieved from <https://dnr.mo.gov/water/business-industry-other-entities/permits-certification-engineering-fees/stormwater/construction-or-land-disturbance-mo-ra00000>.
- Missouri Department of Natural Resources, ABC's of BMP's LLC and Shockey Consulting Services. (January 2011). *Protecting Water Quality: A field guide to erosion, sediment and stormwater best management practices for development sites in Missouri and Kansas*. Retrieved from <https://dnr.mo.gov/document-search/protecting-water-quality-field-guide>.
- United States Environmental Protection Agency. (May 2007). *Developing Your Stormwater Pollution Prevention Plan, A Guide for Construction Sites*. Retrieved from https://www.epa.gov/sites/production/files/2015-10/documents/sw_swppp_guide.pdf.
- Virginia Department of Environmental Quality. (July 2014). *Single Family Residence Common Plan of Development or Sale Stormwater Pollution Prevention Plan Template*. Retrieved from <http://www.deq.virginia.gov/Programs/Water/StormwaterManagement/VSMPPermits/ConstructionGeneralPermit.aspx>.

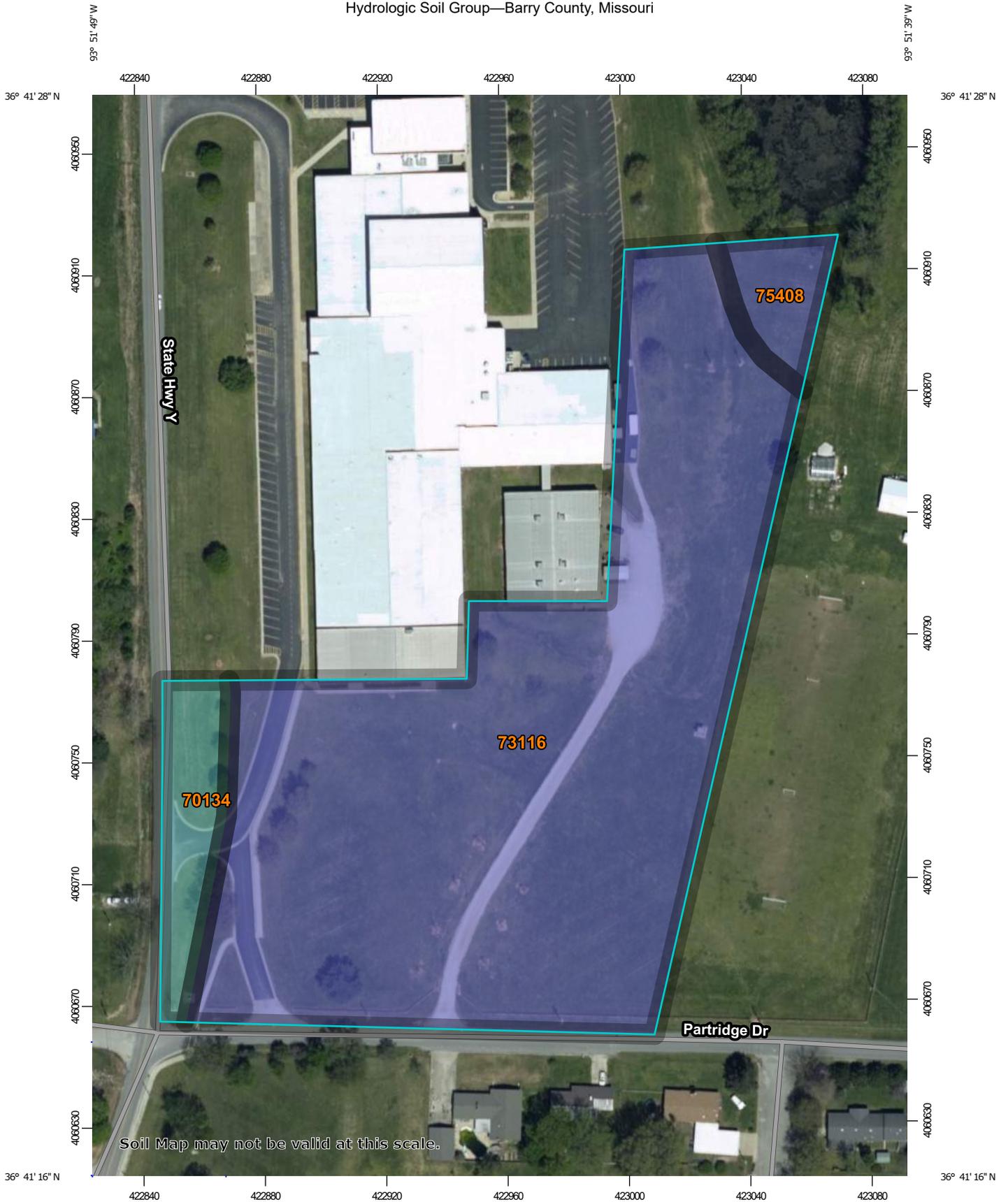
SECTION 4

Location/Topographical Map(s), FIRM Maps & Soils Maps

This section contains:

- Required Location, Vicinity and Topographical Maps (as needed)
- FIRM Maps
- Soils Maps if needed

Hydrologic Soil Group—Barry County, Missouri



Map Scale: 1:1,730 if printed on A portrait (8.5" x 11") sheet.



MAP LEGEND

Area of Interest (AOI)		 C
Area of Interest (AOI)		 C/D
		 D
		 Not rated or not available
Soils		
Soil Rating Polygons		
 A		
 A/D		
 B		
 B/D		
 C		
 C/D		
 D		
 Not rated or not available		
Soil Rating Lines		
 A		
 A/D		
 B		
 B/D		
 C		
 C/D		
 D		
 Not rated or not available		
Soil Rating Points		
 A		
 A/D		
 B		
 B/D		
Water Features		
 Streams and Canals		
Transportation		
 Rails		
 Interstate Highways		
 US Routes		
 Major Roads		
 Local Roads		
Background		
 Aerial Photography		

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Barry County, Missouri
 Survey Area Data: Version 28, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 20, 2019—Jul 17, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
70134	Noark very gravelly silt loam, 8 to 20 percent slopes	C	0.5	6.7%
73116	Pomme silt loam, 2 to 5 percent slopes	B	6.5	89.1%
75408	Secesh silt loam, 0 to 2 percent slopes, rarely flooded	B	0.3	4.2%
Totals for Area of Interest			7.3	100.0%

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

ff1



FHOG

4) 688 888(88)88888

68.82 6888	L.WHFW %D.HJRRG.OH.DWLRQ % -FCH\$ 9 \$ L.WK%RU.FBWK -FCH\$ 88.9 88 \$HODWRAJ.PRRG
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74.L.V.E.S.F.F.S.O.L.H.V.Z.W.K.\$V.W.D.O.O.E.U.G/IRU.W.K.H.X.H.R
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H.O.H.P.O.W.V.G.R.Q.R.W.D.S.S.D.U.E.M.E.S.L.B.H.U.I.O.R.R.G.F.R.H.O.D.E.H.O.V
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U.H.K.O.D.W.R.U.S.U.S.R.V.H

SECTION 5

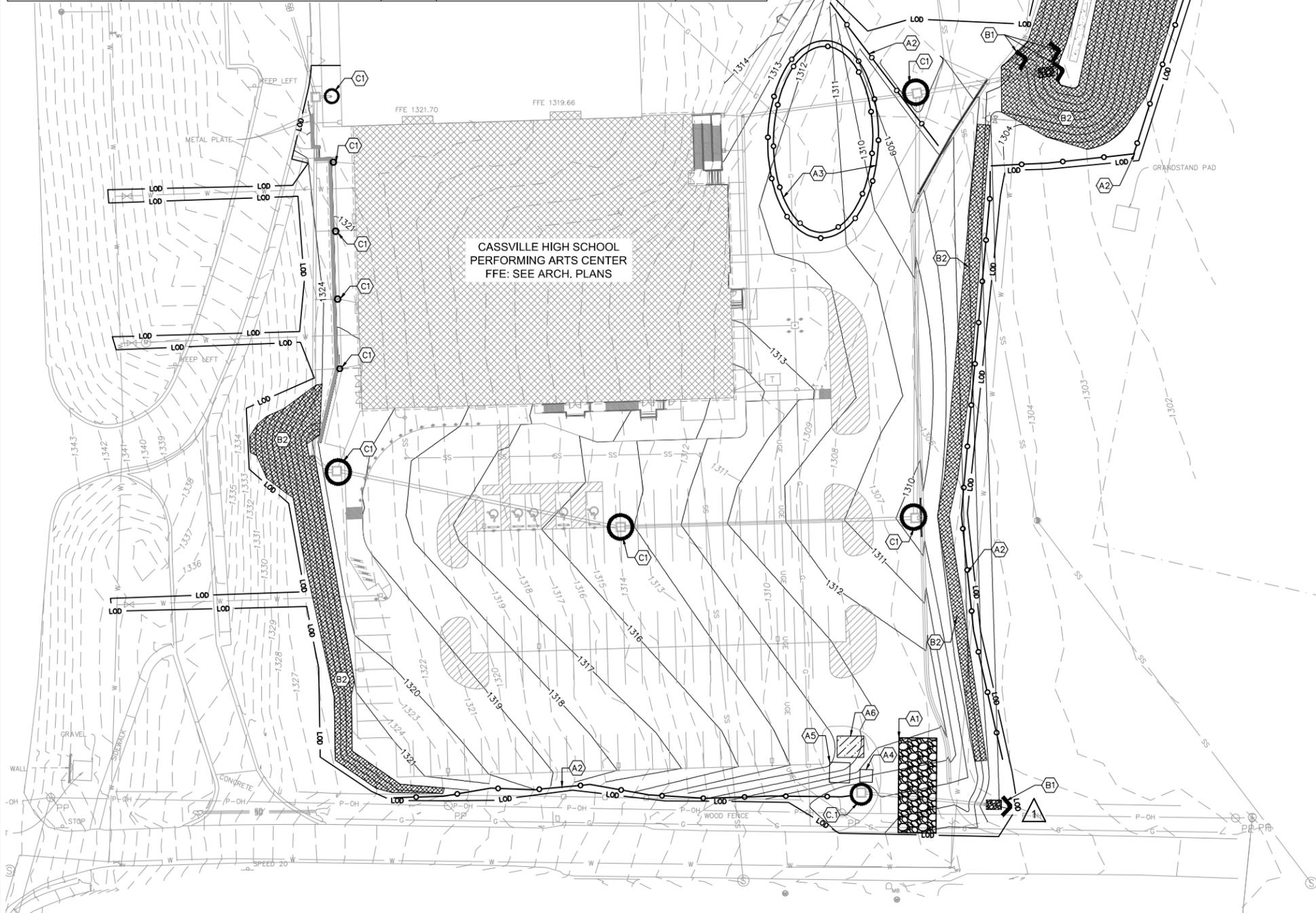
BMP Tracking Map & Land Disturbance Tracking Log

This section contains:

- Erosion and Sediment Control Plan sheet excerpts
- Post Construction Stormwater Management Plan sheets if applicable
- BMP Tracking Map (Working SWPPP Map)
 - Record of Land Disturbance, Stabilization and BMP installation and removal
 - Record of Dewatering Activities (e.g. dates and estimated volume of water discharged)

EROSION CONTROL PHASING CHART

PROJECT STAGE	BMP PLAN REF. #	BMP DESCRIPTION	REMOVE AFTER STAGE	NOTES:	INSTALLATION DATE / REMOVAL DATE
A - PRE-CONSTRUCTION	A1	CONSTRUCTION ENTRANCE/EXIT	D	SEE DETAIL SHEET C8.1	
	A2	TEMPORARY COMPOST FILTER SOCK	D	SEE DETAIL SHEET C8.1	
	A3	TEMPORARY STAGING/STOCKPILE AREA	C	SEE APPROX. LOCATION ON THIS SHEET	
	A4	INSTALL PORTA-POTTY(S)	D	CONTRACTOR TO MARK FINAL PLACEMENT.	
	A5	INSTALL DUMPSTER, SITE SIGN & SPILL KIT	D	CONTRACTOR TO MARK FINAL PLACEMENT.	
	A6	INSTALL CONCRETE WASHOUT	C	SEE DETAIL SHEET C8.1	
B - MASS GRADING	TEMPORARY SEEDING		N/A	PROVIDE TEMPORARY SEEDING (SEE EROSION CONTROL NOTES ON THIS SHEET & TEMP. SEEDING NOTES ON SHEET C8.1)	
	B1	INSTALL FLARED END ROCK CHECK	D	SEE DETAIL SHEET C8.1	
C - BUILDING CONSTRUCTION & ON-SITE IMPROVEMENTS	B2	INSTALL SLOPE REINFORCEMENT	N/A		
	C1	INSTALL INLET PROTECTION	D	SEE DETAIL SHEET C8.1	
	C2	INSTALL OUTLET PROTECTION	D	SEE DETAIL SHEET C8.1	
D - POST-CONSTRUCTION / FINAL STABILIZATION	C3	CONTRACTOR SHALL MAINTAIN EROSION CONTROL DEVICES THROUGHOUT CONSTRUCTION PHASE			
	D1	PLACE TOPSOIL, INSTALL EROSION CONTROL MATTING SEED, MULCH, HYDROSEED, LANDSCAPE	N/A	ESTABLISH PERENNIAL VEGETATION WITH A 70% DENSITY OVER 100% OF DISTURBED AREA. REFER TO LANDSCAPE PLANS FOR ADDITIONAL INFORMATION.	



EROSION CONTROL NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE OF ALL EROSION & SEDIMENT CONTROL MEASURES AND PRACTICES THROUGHOUT THE PROJECT. ANY AND ALL FINES ASSOCIATED WITH EROSION CONTROL VIOLATIONS WILL BE THE CONTRACTOR'S RESPONSIBILITY.
2. EROSION CONTROL IS THE CONTRACTOR'S RESPONSIBILITY. THIS PLAN SHOULD BE USED AS A GUIDE AND REPRESENTS THE MINIMUM EROSION CONTROL DEVICES REQUIRED.
3. EROSION CONTROL MEASURES WILL BE MAINTAINED AT ALL TIMES. ADDITIONAL EROSION & SEDIMENT CONTROL MEASURES WILL BE INSTALLED IF DEEMED NECESSARY BY ON-SITE INSPECTION.
4. CONTRACTOR IS RESPONSIBLE FOR REPAIRING ALL EROSION & SEDIMENT CONTROL DEVICES AFTER EACH RAINFALL EVENT.
5. THE CONTRACTOR SHALL PROVIDE ANY FURTHER EROSION CONTROL MEASURES IN ADDITION TO THOSE LISTED TO ENSURE THAT SILT WILL NOT LEAVE THE PROJECT CONFINES.
6. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING THE TEMPORARY EROSION & SEDIMENT CONTROL DEVICES AFTER COMPLETION OF CONSTRUCTION AND ONLY WHEN AREAS HAVE BEEN STABILIZED WITH A HEALTHY STAND OF PERMANENT VEGETATION.
7. THE CONTRACTOR IS RESPONSIBLE FOR REMOVING SILT FROM SITE IF NOT REUSABLE ON-SITE AND ASSURING PLAN ALIGNMENT AND GRADE IN ALL DITCHES AT COMPLETION OF CONSTRUCTION.
8. THE CONTRACTOR SHALL ENSURE THAT ALL DRAINAGE STRUCTURES, FLUMES, PIPES, ETC. ARE CLEANED OUT AND WORKING PROPERLY AT TIME OF ACCEPTANCE.
9. THE CONTRACTOR SHALL PROVIDE ANY TEMPORARY STABILIZATION AS REQUIRED.
10. THE CONTRACTOR SHALL PROVIDE A TEMPORARY CONSTRUCTION ENTRANCE FOR VEHICULAR TRAFFIC AT LOCATION SHOWN.
11. ALL EROSION CONTROL DEVICES SHALL CONFORM TO THE APPLICABLE SECTIONS OF THE STANDARD SPECIFICATIONS AND DESIGN CRITERIA OF THE ENGINEERING DIVISION, DEPARTMENT OF PUBLIC WORKS, CITY OF CASSVILLE, MISSOURI.
12. REFERENCE DETAILS ON SHEET C8.1 FOR TYPICAL EROSION CONTROL DEVICE INSTALLATION.
13. THE CONTRACTOR WILL BE REQUIRED TO CLEAN THE STREETS OF DEPOSITED MUD AS FREQUENTLY AS NEEDED AS DETERMINED BY THE ENGINEER IN ORDER TO KEEP THEM USABLE AND TO CONTROL DUST.
14. SEE TEMPORARY VEGETATION REQUIREMENT NOTES ON THIS SHEET FOR EXPOSED SOIL WHERE NO ACTIVITY WILL OCCUR FOR MORE THAN 14 DAYS.
15. CONTRACTOR IS RESPONSIBLE FOR PHASED INSTALLATION OF EROSION CONTROL BMP'S IN ORDER TO PREVENT SEDIMENT FROM BREACHING THE LIMITS OF DISTURBANCE.
16. GRADING SHOWN AT 4:1 MAXIMUM SLOPES. ALL SLOPES OVER 4:1 SHALL RECEIVE EROSION CONTROL BLANKET OR SOD.

LEGEND

- RIGHT-OF-WAY LINE
- - - PROPERTY LINE
- - - EXIST. CONTOUR
- - - FINISH GRADE CONTOUR
- - - LIMITS OF DISTURBANCE
- INSTALL COMPOST FILTER SOCK
- INSTALL INLET PROTECTION
- INSTALL GRAVEL CONSTRUCTION ENTRANCE/EXIT
- INSTALL CONCRETE WASHOUT
- △ # STORM OUTFALL
- INSTALL NORTH AMERICAN GREEN SC-150 EROSION CONTROL BLANKET PER MANUFACTURER'S RECOMMENDATIONS ON SLOPES 4:1 OR STEEPER. ECB SHALL BE INSTALLED INCREMENTALLY AS FILL IS ADDED.

LAND DISTURBANCE:

TOTAL AREA DISTURBED: 3.02± AC



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 637 COLLEGE STREET
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MEP ENGINEER
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CONSTRUCTION MANAGER
 RE: BATH CONSTRUCTION COMPANY
 1308 W 2103 ST
 JOPLIN, MO 64801
 417-623-4545



RICKY GENE HAASE - CIVIL ENGINEER
 MO# PE-2019017828
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 REVISION SCHEDULE

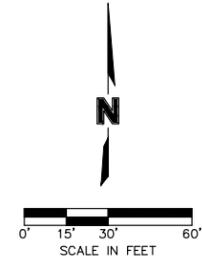
PROJECT DESCRIPTION:
CASSVILLE HS: PERFORMING ARTS CENTER

PROJECT ENGINEER: RGH
 DRAWN BY: BWS
 CHECKED BY: RVJ

PROJECT NUMBER:
21-620
 DATE:
 2023.05.17

EROSION CONTROL PLAN

SHEET NUMBER:
C8.0



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SECTION 6

BMP Specification & Detail Sheets

TEMPORARY VEGETATION REQUIREMENTS:

TOPSOIL REQUIREMENTS:

TEMPORARY SEEDING – LOOSEN COMPACTED SOILS TO A DEPTH OF 4 INCHES. IF RAINFALL CAUSES THE SURFACE TO BECOME SEALED OR CRUSTED, LOOSEN IT JUST PRIOR TO SEEDING. SLOPES STEEPER THAN 3:1 GRADE SHOULD BE GROOVED OR FURROWED ON THE CONTOUR BEFORE SEEDING. A GOOD SEEDBED IS WELL PULVERIZED, LOOSE, AND UNIFORM.

LIME REQUIREMENTS:

TEMPORARY SEEDING – LIME SHOULD BE APPLIED ACCORDING TO SOIL TEST RECOMMENDATIONS. IF THE PH OF THE SOIL IS UNKNOWN, LIME SHALL BE INCORPORATED INTO THE TOP 4 INCHES OF SOIL AT THE RATE OF 1500 POUNDS EFFECTIVE NEUTRALIZING MATERIAL (ENM) PER ACRE. SOILS WITH A PH OF SIX OR HIGHER NEED NOT BE LIMED.

FERTILIZER REQUIREMENTS:

TEMPORARY SEEDING – FERTILIZER SHOULD BE APPLIED BASED ON SOIL TESTS. WHEN THESE ARE NOT POSSIBLE, A 10-10-10 GRADE FERTILIZER SHALL BE INCORPORATED INTO THE TOP 4 INCHES OF SOIL AT THE RATE OF 200 POUNDS PER ACRE.

SEED REQUIREMENTS:

TEMPORARY SEEDING – SEED MIX SHALL CONSIST OF ANY COMBINATION OF TALL FESCUE, ANNUAL RYEGRASS, SUDAN, MILLET, WHEAT, OR OATS. SEED MIXTURE SHALL BE APPLIED AT A RATE OF 200 POUNDS PER ACRE.

DORMANT SEASON SEEDING – SEED MIX SHALL CONSIST OF 80 PERCENT (80%) TALL FESCUE, TEN PERCENT (10%) ANNUAL RYEGRASS, AND TEN PERCENT (10%) SPRING OATS. SEED MIXTURE SHALL BE APPLIED AT A RATE OF 600 POUNDS PER ACRE.

MULCH REQUIREMENTS:

TEMPORARY SEEDING – WHERE SLOPES ARE LESS THAN 25 PERCENT (4:1) GRADE, CEREAL GRAIN MULCH IS REQUIRED AT THE RATE OF 100 POUNDS PER 1,000 SQUARE FEET (4,500 LBS/ACRE). CEREAL GRAIN MULCH SHALL MEET THE REQUIREMENTS OF SECTION 802 OF THE MISSOURI STATE SPECIFICATIONS FOR HIGHWAY CONSTRUCTION FOR TYPE 1 MULCH. WHERE SLOPES ARE 25 PERCENT (4:1) OR GREATER GRADE, TYPE 3 MULCH ("HYDROMULCH") MEETING THE REQUIREMENTS OF SECTION 802 OF THE STATE SPECIFICATIONS SHALL BE USED. TYPE 3 MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 2,000 LBS/ACRE.

DATES FOR SEEDING:

TEMPORARY SEEDING – CAN OCCUR DURING ANY SEASON, HOWEVER WINTER IS THE LEAST TOLERANT. DORMANT SEASON SEEDING – DECEMBER 15 TO FEBRUARY 29

POLLUTION PREVENTION PROCEDURE NOTES:

1. HANDLING AND DISPOSAL OF HAZARDOUS MATERIALS:

DO: PREVENT SPILLS
USE PRODUCTS UP
FOLLOW LABEL DIRECTIONS FOR DISPOSAL
REMOVE LIDS FROM EMPTY BOTTLES AND CANS WHEN DISPOSING TRASH
RECYCLE WASTES WHENEVER POSSIBLE

DON'T: DON'T POUR WASTE INTO SEWERS OR WATERWAYS ON THE GROUND
DON'T POUR WASTE DOWN THE SINK, FLOOR DRAIN OR SEPTIC TANKS
DON'T BURY CHEMICALS OR CONTAINERS, OR DISPOSE OF THEM WITH

OTHER WASTE
DON'T BURN OR MIX CHEMICALS OR CONTAINERS
DON'T WASH SEDIMENT DOWN STORM SEWER INLETS

2. CONTAINERS SHALL BE PROVIDED FOR COLLECTION OF ALL WASTE MATERIAL INCLUDING CONSTRUCTION DEBRIS, TRASH, PETROLEUM PRODUCTS AND ANY HAZARDOUS MATERIALS TO BE USED ONSITE. ALL WASTE MATERIAL SHALL BE DISPOSED OF AT FACILITIES APPROVED FOR THAT MATERIAL.

3. NO WASTE MATERIALS SHALL BE BURIED ON-SITE.

4. MIXING, PUMPING, TRANSFERRING OR OTHERWISE HANDLING CONSTRUCTION CHEMICALS SUCH AS FERTILIZER, LIME, ASPHALT, CONCRETE DRYING COMPOUNDS, AND ALL OTHER POTENTIALLY HAZARDOUS MATERIALS SHALL BE PERFORMED IN AN AREA AWAY FROM ANY WATERCOURSE, DITCH OR STORM DRAIN.

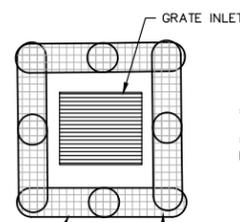
5. EQUIPMENT FUELING AND MAINTENANCE, OIL CHANGING, ETC., SHALL BE PERFORMED ONLY IN AN AREA DESIGNATED FOR THAT PURPOSE. THE DESIGNATED AREA SHALL BE EQUIPPED FOR RECYCLING OIL AND CATCHING SPILLS.

6. CONCRETE WASH WATER SHALL NOT BE ALLOWED TO FLOW DIRECTLY TO STORM SEWERS, STREAMS, DITCHES, LAKES, ETC WITHOUT BEING TREATED. A CONCRETE WASHOUT AREA SHALL BE PROVIDED. SEE DETAIL ON THIS SHEET.

7. ALL PAINT, SOLVENTS, PETROLEUM PRODUCTS AND PETROLEUM WASTE PRODUCTS, AND STORAGE CONTAINERS (SUCH AS DRUMS, CANS, OR CARTONS) SHALL BE STORED ACCORDING TO BMPs. THE MATERIALS EXPOSED TO PRECIPITATION SHALL BE STORED IN WATERTIGHT, STRUCTURALLY SOUND, CLOSED CONTAINERS. ALL CONTAINERS SHALL BE INSPECTED FOR LEAKS OR SPILLAGE DURING THE ONCE PER WEEK INSPECTION OF BMPs. IF SUBSTANCES SUCH AS OIL, DIESEL FUEL, HYDRAULIC FLUID, ANTIFREEZE, ETC. ARE SPILLED, LEAKED, OR RELEASED ONTO SOIL, THE SOIL SHALL BE DUG UP AND PROPERLY DISPOSED OF. SPILLS ON PAVEMENT SHALL BE ABSORBED WITH SAWDUST, KITTY LITTER OR PRODUCT DESIGNED FOR THAT PURPOSED AND DISPOSED OF AT A LICENSED SANITARY LANDFILL. HAZARDOUS OR INDUSTRIAL WASTES SUCH AS MOST SOLVENTS, GASOLINE, OIL-BASED PAINTS, AND CEMENT CURING COMPOUNDS REQUIRE SPECIAL HANDLING. THESE MATERIALS WILL BE REMOVED FROM THE SITE AND RECYCLED OR DISPOSED OF IN ACCORDANCE WITH MODNR REQUIREMENTS.

8. STATE LAW REQUIRES THE PARTY RESPONSIBLE FOR A PETROLEUM PRODUCT SPILL IN EXCESS OF 50 GALLONS TO REPORT THE SPILL TO MODNR (573-634-2436) AS SOON AS PRACTICAL AFTER DISCOVERY. FEDERAL LAW REQUIRES THE RESPONSIBLE PARTY TO REPORT ANY RELEASE OF OIL IF IT REACHES OR THREATENS A SEWER, LAKE, CREEK, STREAM, RIVER, GROUNDWATER, WETLAND, OR AREA, LIKE A ROAD DITCH, THAT DRAINS INTO ONE OF THE ABOVE.

9. SUFFICIENT TEMPORARY TOILET FACILITIES TO SERVE THE NUMBER OF WORKERS ON THE SITE SHALL BE PROVIDED. THE FACILITIES SHALL BE SERVICED FREQUENTLY TO MAINTAIN A SANITARY CONDITIONS.



NOTE:
GRAVEL BAGS (**FILTER SOCKS) SHALL BE INSPECTED AND REPLACED AS NEEDED

* 5/8 - 1 1/2" CRUSHED LIMESTONE
** COMPOST FILTER SOCKS MAY BE USED IN LIEU OF GRAVEL BAGS

*GRAVEL CONTAINED IN PERVIOUS BURLAP BAGS OR SYNTHETIC NET BAGS (1/8-INCH MESH) APPROXIMATELY 24 INCHES LONG, 12 INCHES WIDE AND 6 INCHES HIGH (I.E. CURB HEIGHT)
PLACE **GRAVEL FILTER BAGS SUCH THAT NO GAPS ARE EVIDENT

GRATE INLET PROTECTION DETAIL
NOT TO SCALE

NOTES:

1. ACTUAL LAYOUT LOCATIONS & NUMBER OF WASH-OUTS TO BE DETERMINED BY CONTRACTOR IN FIELD.

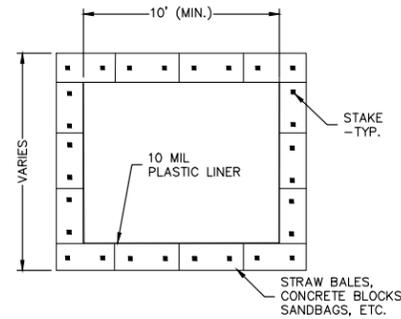
2. THE CONCRETE WASH-OUT SIGN SHALL BE INSTALLED WITHIN 30 FT. OF THE TEMPORARY CONCRETE WASHOUT FACILITY.

3. WASH-OUTS SHALL BE LOCATED A MINIMUM OF 50 FT. FROM STORM DRAINS, OPEN DRAINAGE FACILITIES AND WATER COURSES. AVOID MIXING EXCESS AMOUNTS OF FRESH CONCRETE.

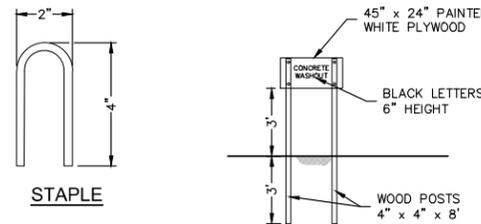
4. INSTALL BEFORE THE START OF ANY CONCRETE ACTIVITIES OR DELIVERIES.

5. INSPECT EVERY WEEK AND AFTER 1/2" STORM EVENT. REMOVE AND DISPOSE OF HARDENED CONCRETE AND RETURN THE FACILITY TO A FUNCTIONAL CONDITION. WASH-OUT FACILITIES MUST BE CLEANED, OR NEW FACILITIES MUST BE CONSTRUCTED AND READY FOR USE ONCE THE WASH-OUT IS 75% FULL.

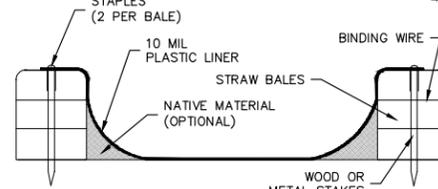
6. WHEN TEMPORARY CONCRETE WASH-OUT FACILITIES ARE NO LONGER REQUIRED FOR THE WORK, THE HARDENED CONCRETE SHOULD BE REMOVED AND DISPOSED. MATERIALS USED TO CONSTRUCT TEMPORARY CONCRETE WASH-OUT FACILITIES SHALL BE REMOVED FROM THE SITE AND DISPOSED. HOLES, DEPRESSIONS OR OTHER GROUND DISTURBANCE CAUSED BY THE REMOVAL OF THE WASH-OUT SHALL BE BACKFILLED AND REPAIRED.



PLAN



WASHOUT SIGN

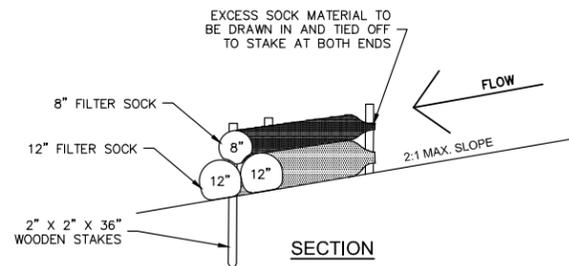


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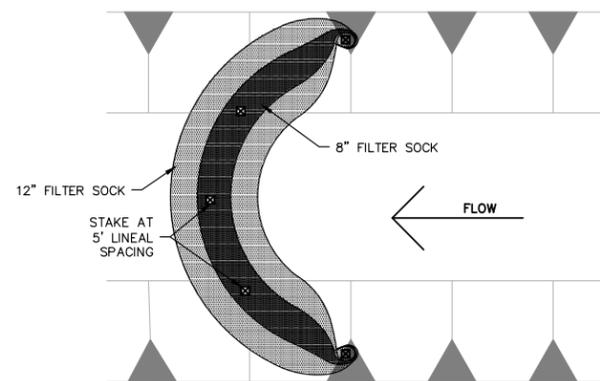
CONCRETE WASH-OUT DETAIL
NOT TO SCALE

NOTES:

1. COMPOST FILTER SOCK SHALL MEET THE REQUIREMENTS OF MoDOT SECTION 806.8.6.4.8. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO ENGINEER FOR APPROVAL BEFORE INSTALLING SOCK.
2. FILTER SOCK DEPICTED IS FOR MINIMUM SLOPES. GREATER SLOPES MAY REQUIRE LARGER SOCKS PER ENGINEER.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.
4. SEDIMENT SHOULD BE REMOVED FROM BEHIND DITCH CHECK ONCE THE ACCUMULATED HEIGHT HAS REACHED 1/2 THE HEIGHT OF THE DITCH CHECK



SECTION

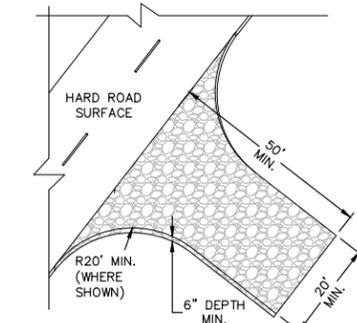


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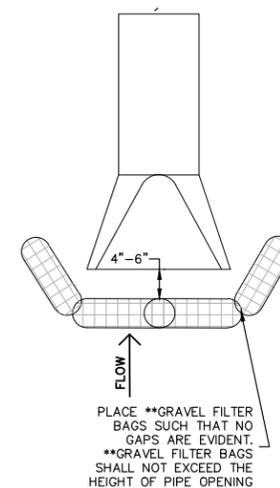
COMPOST FILTER SOCK DITCH CHECK DETAILS
NOT TO SCALE

NOTES:

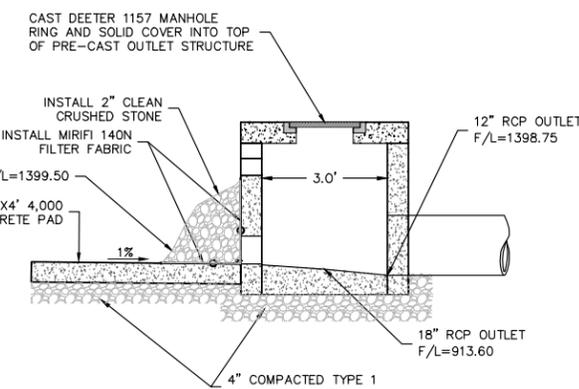
1. INSTALL AS SOON AS POSSIBLE BEFORE START OF GRADING
2. PLACE FILTER FABRIC UNDER STONE
3. USE 3" - 6" CLEAN CRUSHED LIMESTONE
4. REPLACE AS NEEDED TO MAINTAIN 6" DEPTH



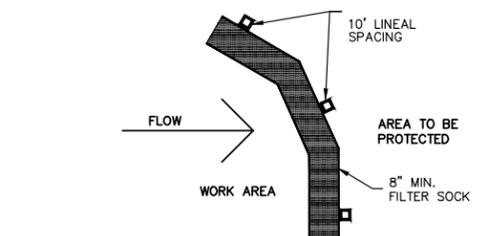
GRAVEL CONSTRUCTION ENTRANCE / EXIT
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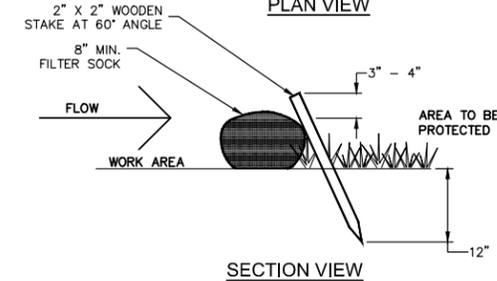
PLAN VIEW @ F.E.S.



OUTLET PROTECTION DETAIL
NOT TO SCALE



PLAN VIEW



SECTION VIEW

NOTES:

1. COMPOST FILTER SOCK SHALL MEET THE REQUIREMENTS OF MoDOT SECTION 806.8.6.4.8. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS TO ENGINEER FOR APPROVAL BEFORE INSTALLING SOCK.
2. FILTER SOCK DEPICTED IS FOR MINIMUM SLOPES. GREATER SLOPES MAY REQUIRE LARGER SOCKS PER ENGINEER.
3. COMPOST MATERIAL TO BE DISPERSED ON SITE, AS DETERMINED BY ENGINEER.

COMPOST FILTER SOCK DETAILS
NOT TO SCALE

DITCH CHECK SPACING (ROCK OR FIBER MATERIAL)	
DITCH SLOPE (%)	SPACING @ 18" EFFECTIVE HT. (FT)
1.0	150
2.0	75
3.0	50
4.0	38
5.0	30
6.0	25
7.0	21
8.0	19
9.0	17
10.0	15

NOTES:

1. REFER TO CITY OF CASSVILLE DETAIL IF DEWATERING OF BASIN IS NECESSARY. TRENCHING THROUGH THE BASIN BERM TO RELEASE WATER OR OTHER DEWATERING METHODS THAT DO NOT USE APPROPRIATE BMPs IS PROHIBITED.
2. SEDIMENT SHALL BE REMOVED PRIOR TO SEEDING THE BASIN.
3. FABRIC AND ROCK SHALL BE REMOVED WHEN UPSTREAM AREA HAS BEEN STABILIZED.
4. FILTER FABRIC AND ROCK SHALL BE PLACED ONLY IN FRONT OF PERFORATED PLATE AND SHALL NOT COVER THE OVERFLOW OPENING.



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MO# PE-2019017828

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100% CDS
REVISION SCHEDULE

PROJECT DESCRIPTION:
CASSVILLE HS: PERFORMING ARTS CENTER
1825 State Hwy Y, Cassville, MO 65625

PROJECT ENGINEER: RGH
DRAWN BY: BWS
CHECKED BY: RWJ

PROJECT NUMBER:
21-620

DATE:
2023.05.17

EROSION CONTROL DETAILS

SHEET NUMBER:

C8.1



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Parking and Material Laydown Areas



Figure 6.10 Laydown and storage areas should be neat and fully stabilized. Source: *ABC's of BMP's*

Practice Description

Many construction sites have a designated area for a construction trailer, parking and storage of construction material usually referred to as a laydown area. The area itself is not considered a best management practice but management of the area is.

Recommended Minimum Requirements

This area should be within the permitted area to be disturbed and should be located no closer than 100 feet from streams, wetlands, natural drainageways or other environmentally sensitive areas. Although the tendency is to park vehicles in shaded areas, this area should not be placed within the canopy of plants expected to remain on-site. The root zone of plants is generally as broad as the canopy. The area should be stabilized with vegetation or a small rock and gravel base depending on the amount of traffic in the area and should not contribute pollutants to the stormwater discharge. The area should be clearly marked on the SWPPP site map.

Construction

The parking and laydown areas as well as the traffic paths into and out of these areas should be stabilized. They are most often placed near the exit of the construction site and therefore can contribute to off-site sediment tracking if not managed properly.

Troubleshooting

Keep the area free and clear of trash and debris. Provide a location for trash disposal (e.g., dumpster) in an appropriate location. See the Solid Waste section under [Pollution Prevention](#).

Maintenance, Inspection and Removal

- Inspect the area on a weekly basis and after rain events.
- Ensure that materials are properly stored and contained with Material Safety Data Sheets, or MSDS, information readily available.
- Removal of this temporary device must be performed and the site stabilized prior to filing [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 (see [Chapter One-Missouri Permit Requirements](#)).

Common Problems and Solutions

Problem	Solution
Sediment is being transported onto a public street when exiting the parking or laydown area; the area is eroding or traffic carries mud to the street.	Add rock over the area to stabilize it.
Vehicles sink into the soil caused by a soft subgrade.	Lay a geotextile membrane over the area and add a layer of small rock or gravel.

Topsoiling: Removal, Stockpiling and Replacement



Figure 6.16 It's important to mix or incorporate topsoil with the underlying subsoil to prevent sloughing on sloping soils.
Source: C. Rahm, NRCS, St. Louis Co.

Practice Description

Topsoiling is a method of preserving the topsoil prior to construction, stockpiling it and using it after construction to help establish vegetation on a construction site. Stockpiling is also used for storage of other soils and construction material such as fill material. These practices apply to areas on a site to be disturbed by excavation, compaction or filling, and where vegetation is to be reestablished.

Recommended Minimum Requirements

Prior to the start of construction, topsoiling should be designed by a qualified professional. The existing soil should be tested to ensure the material to be saved is topsoil and helps with vegetation establishment and long-term, permanent growth. The location of other material to be stockpiled on the site should be shown on the site map and stabilized according to the regulations. Refer to the plans and specifications throughout the construction process.

Topsoil

- Surface soil or top layer of undisturbed soil, usually richest in organic matter and nutrients.
- Should be free of debris, trash, stumps, large rocks, roots and noxious weeds. It should contain no substance potentially toxic to plant growth.

Minimum Soil Depth

- 24 inches of total soil depth over bedrock (combined topsoil and subsoil); from 8- to 12-inches of total soil depth over loose sand or rock.
- The top 4- to 6-inches of soil must be good topsoil, rich with organic matter, microorganisms and not more than 50 percent clay content to ensure good vegetation establishment and growth on a permanent basis.

pH Range

- From 6.0 to 7.5.
- If the pH is less than 5.2, lime should be incorporated in accordance with soil test results.

Construction

Site Preparation

- Establish all perimeter erosion and sediment control practices, (e.g., sediment barriers, diversions, grade stabilization structures, berms, dikes, sediment basins) before stripping.

Stripping

- Strip topsoil from areas that will be disturbed by excavation, filling or compaction by equipment.
- Determine depth of stripping by taking soil cores at several locations within each area to be stripped.
- Make sure the soil being saved is topsoil. It should have a minimum of five percent organic material and a clay content of less than 50 percent.

Stockpiling

- Do not place topsoil or other stockpiles near areas of water (e.g., conveyances, ditches, swales).
- Do not place stockpiles on impervious surfaces or within 50 feet of storm drain inlets.
- Avoid placing topsoil or stockpiling other material on steep slopes. Side slopes of stockpile should not exceed 2:1.
- Use sediment fences or other barriers where necessary to retain sediment.
- Protect topsoil and other stockpiles with temporary seeding or other soil stabilization techniques as soon as possible, but not more than 14 working days after formation of the stockpile. If stockpiles will not be used within 12 months, they should be stabilized by permanent vegetation to control erosion and weed growth.

Grading

Established grades should be maintained according to the approved plan and should not be altered by adding topsoil.

Liming of Subsoil

Where the pH of the existing subsoil is below 5.2, incorporate agricultural limestone in amounts indicated by soil tests or specified for the seeding mixture to be used (See [Temporary or Permanent Seeding](#)). Incorporate lime into the subsoil to a depth of at least two inches by disking. Retest the soil to determine the pH and if pH is not 5.2 or higher, repeat the process.

Roughening

Immediately prior to spreading topsoil, loosen the subgrade by disking or scarifying to a depth of at least two inches to ensure bonding of the topsoil and subsoil.

Spreading Topsoil

- Spreading frozen or muddy topsoil can prevent proper grading or seeding. Uniformly spread topsoil to a minimum compacted depth of four inches. For long-term growth of vegetation without irrigation, minimum soil depth (subsoil and topsoil) should be 8- to 12-inches over loose sand or rock fragments, and 24 inches over bedrock.
- Prior to the establishment of final vegetation, the topsoil should be final graded so it is smooth with no clods greater than one inch in diameter.

Construction Verification

Verify that topsoil was spread evenly and incorporated with underlying subsoil.

Maintenance and Inspection

- Maintain erosion control devices over topsoil until vegetation is fully established with a density of 70 percent over the entire area.
- Inspect topsoiled areas frequently until vegetation is established.
- Repair eroded or damaged areas and revegetate.

Common Problems and Solutions

Problem	Solution
Poor or no vegetation establishment caused by topsoil pH too low.	Add agricultural limestone to adjust pH.
Poor or no vegetation establishment caused by topsoil containing sterilants or toxic chemicals.	Remove contaminated topsoil and replace.
Poor or no vegetation establishment caused by topsoil being too high in clay content or too low in organic material and microorganisms.	Add organic material.
Poor vegetation establishment caused by topsoil being compacted too much during application.	Loosen by disking or scarifying and reseed.
Poor drainage and possible sloughing on steep slopes caused by topsoil not properly bonded to subsoil.	Remove topsoil, roughen subgrade and respread topsoil.
Inadequate vegetation establishment caused by topsoil removed during construction and not replaced.	Add topsoil with a minimum of 5 percent organic material, a clay content under 50 percent, fertilize according to soil test results, reseed or sod site, and apply water to establish vegetation.

Materials Management

Material delivery, handling and storage can generate significant pollution. The site superintendent needs to ensure best management practices are followed to minimize or eliminate the discharge of material pollutants to the storm drain system or watercourse.

Inventory

The site superintendent should develop and maintain an inventory of materials that will be stored outside on the site during construction. For example:

- Pipe, fittings and joint compounds for underground utility piping.
- Gravel and stone bedding material.
- Concrete forming materials.
- Other. (Specify) _____

Delivery

Locations for delivery should be determined and clearly marked. Where beneficial, visibly place signs with delivery instructions for the drivers. Employees trained in emergency spill clean-up procedures need to be present when dangerous materials or liquid chemicals are unloaded.

Storage

Fuels, oils and other petroleum products (e.g., forming oils and compounds; fertilizers; pesticides) or any other hazardous or toxic compounds should be stored under cover and not allowed to come in contact with stormwater on the site. On-site storage should meet all local, state and federal secondary containment rules and regulations. Additionally, local ordinances may require fencing and security measures for storage of these products.

Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and under cover in secondary containment.

Do not store incompatible materials, such as chlorine and ammonia in the same temporary containment facility.

Solid Waste Management



Figure 6.17 This dumpster is in need of routine maintenance and the trash and debris around the area must be disposed of in a proper manner. Source: ABC's of BMP's, LLC

The general contractor is responsible for disposing of all solid waste from the site in accordance with state and local laws and regulations. Dumpsters or other collection containers should be provided as needed and should be covered at all times to reduce the spread of litter and avoid public nuisance and vector concerns. Solid waste may not be buried on the site and may not be open burned except in conformance with the Missouri Air Conservation Law and regulations. Open burning violations are also a violation of the Missouri Solid Waste Management Law.

All solid wastes removed from the construction site must go to a permitted transfer station or landfill and cannot be taken to another unpermitted location for consolidation or processing. Material may be sorted on-site and diverted to acceptable reuse or recycling.

Deconstruction Waste Recycling

Recycling deconstruction waste is one way to minimize solid waste disposal costs and pollution. For information about local outlets for deconstruction materials, contact your area Solid Waste Management District.

There are 20 Solid Waste Management Districts in the State of Missouri. Search their contact information at:

- Solid Waste Management District Contacts located at www.dnr.mo.gov/env/swmp/swmd/swmdinfo.htm or by calling 800-361-4827.
- Missouri Construction and Demolition Waste Guidance www.dnr.mo.gov/env/cdwaste.htm.
- Additional information is available at:
 - Mid America Regional Council (Kansas City region) at 816-474-4240 or www.recyclespot.org.
 - Construction Industry Compliance Assistance Center at www.cicacenter.org/
 - Toolbase Services: Construction Waste Management at www.toolbase.org/Best-Practices/Construction-Waste/construction-waste-management.

Recommended Minimum Requirements

- Solid waste management procedures and practices are designed to minimize or eliminate the discharge of pollutants to the drainage system or to watercourses as a result of the creation, stockpiling or removal of construction site wastes.
- Construction projects should be designed and implemented to minimize the amount of wasted materials.
- Materials should be purchased with minimal packaging.
- Solid waste management procedures and practices must be implemented on all construction projects that generate solid wastes. Solid wastes that are commonly found on construction and demolition sites include but are not limited to:
 - Construction wastes (e.g., lumber, wood sheeting products, steel and metal scraps, sawdust, pipe and electrical cuttings, non-hazardous equipment parts, polystyrene (Styrofoam), wall board, miscellaneous types of insulation, roofing materials, empty containers and other materials used to transport and package construction materials).
 - Landscaping vegetation waste and landscape plant containers.
 - Packaging materials.
 - Litter, including food containers, beverage cans, coffee cups, paper bags, plastic wrappers and smoking materials, including litter generated by the public.

Employee Training

Employees should be trained and educated as part of good housekeeping and pollution prevention on a construction site.

- Instruct employees and subcontractors about identification of solid waste and hazardous waste.
- Educate employees and subcontractors about solid waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures. incorporate procedures into regular safety meetings.

- Require employees and subcontractors follow solid waste handling and storage procedures.
- Prohibit littering by employees, subcontractors and visitors.
- Minimize production of solid waste materials wherever possible.

Collection, Storage, Recycling and Disposal

- Construction and landscaping material waste should be recycled and reused as much as possible.
 - Landscaping vegetation should be shredded and used as mulch when possible.
 - Materials from demolished structures should be recovered for reuse or recycling when possible.

Note: Any separating of recoverable materials for reuse or recycling must occur on the property of origin. Solid waste cannot be removed to another location for sorting or separating without a permit from the Department of Natural Resources' Solid Waste Management Program.
- Salvage or recycle useful vegetation debris, packaging or surplus building materials when practical. For example, trees and shrubs from land clearing can be converted into wood chips, and then used as mulch on graded areas. Recycle wood pallets, cardboard boxes and construction scraps.
- Provide dumpsters of sufficient size and number to contain the solid waste generated by the project. Dumpsters should be covered at all times and be properly serviced.
- Provide trash receptacles in the permittee's yard, field trailer areas and at locations where workers congregate for lunch and break periods.
- Locate solid waste storage areas at least 50 feet from drainage facilities and watercourses and should not be located in areas prone to flooding or ponding of water.
- Collect construction debris and litter from work areas within the construction limits of the project site on a daily basis and place in watertight dumpsters, regardless of whether the litter was generated by the permittee, the public or others.
- Empty dumpsters weekly from the site. Dispose of the contents in accordance with Missouri State solid waste regulations. While demolition and construction debris typically do not emit a lot of odors, food waste from workers can cause an odor problem and attract public complaints.
- Properly dispose of the waste at a permitted solid waste transfer station or a permitted sanitary or demolition landfill.
- Do not place collected litter and debris in or next to drain inlets, stormwater drainage systems or watercourses.
- Prohibit littering on the project site and perform periodic litter removal from the area to reduce public nuisance concerns from airborne and waterborne litter.
- To prevent clogging of the storm drainage system, litter and debris removal from drainage grates, trash racks, and ditch lines should be a priority.
- Remove construction debris and waste from the site as necessary to maintain a safe environment and to avoid public nuisance issues related to airborne and waterborne trash or vectors.

- Store or stack construction material visible to the public in an orderly manner and manage it to protect the value of the material. Materials stored in a waste like manner are regulated by the Missouri Department of Natural Resources' Solid Waste Management Program or Kansas Department of Health and Environment's Bureau of Waste Management.
- Prevent stormwater run-on from contacting stored solid waste through the use of covered containers. Recovered or recycled materials should be covered, or the area in use should include berms, dikes, other temporary diversion structures or the use of measures to elevate waste from site surfaces to avoid contact with stormwater.
- Construction and highway planting waste not stored in watertight dumpsters need to be securely covered from wind and rain by covering the waste with tarps or plastic sheeting or protected in conformance with the applicable disturbed soil area protection section.
- Dumpster washout on the project site is typically not allowed by the permits.
- Notify trash hauling contractors that only watertight dumpsters are acceptable for use on-site.
- Store potentially hazardous waste from non-hazardous construction site waste.
- Keep the site clean of litter debris.
- Make sure that toxic liquid wastes (e.g., used oils, solvents, and paints) and chemicals (e.g., acids, pesticides, additives, curing compounds) are not disposed of in dumpsters designated for construction debris.
- Dispose of non-hazardous waste in accordance Missouri State solid waste regulations.
- Remove this temporary device and stabilize the site prior to filing [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 (see [Chapter 1 -Missouri Permit Requirements](#)) for termination of permit coverage.

Maintenance, Inspection and Removal

- Inspect all dumpsters on a weekly basis and after rain events.
- Remove full dumpsters from the project site and dispose the contents in accordance with Missouri Solid Waste Management Law and regulations.
- Handle and dispose litter stored in collection areas and containers properly.
- Remove construction debris and waste from the site as necessary. The debris and waste cannot cause a public nuisance or health hazard.

Common Problems and Solutions

Problem	Solution
Trash and debris blowing out of dumpster caused by lack of a cover or overfilling.	Cover dumpster and debris with a tarp or other waterproof cover until the dumpster service provider can bring a new dumpster or empty the existing one. Insist on a unit with a properly working lid or cover, if not provided.

Sanitary Waste Management



Figure 6.18 Typical port-a-potty with secondary containment and tie downs. Source: BFA Inc.

Sanitary waste management consists of procedures and practices to minimize or eliminate the discharge of sanitary or septic waste materials to the storm drain system or watercourses. The general contractor is responsible for providing sanitary facilities appropriate to the number of employees on the site. Sanitary and septic waste management practices are to be implemented on all construction sites that use temporary or portable sanitary or septic waste systems. Sanitary waste may only be disposed of in accordance with the Missouri Clean Water Law.

Recommended Minimum Requirements

Written Procedures and Practices

Written procedures and practices should be referenced in the stormwater pollution prevention plan, or SWPPP. Plans should be posted on the portable facilities and at the office. The site superintendent and field personnel should ensure procedures and practices are followed at all times.

Documentation

Log all education, maintenance, inspection and removal activities in case questions arise during inspections and for reference when troubleshooting problems.

Education

- Educate employees, subcontractors and suppliers about potential dangers to humans and the environment from sanitary or septic wastes.
- Instruct employees, subcontractors and suppliers in identification of sanitary and septic waste.
- Educate employees, subcontractors and suppliers about sanitary and septic waste storage and disposal procedures.
- Hold regular meetings to discuss and reinforce disposal procedures. Incorporate procedures into regular safety meetings.
- Establish a continuing education program to update new employees.

Location, Storage and Disposal Procedures

- In order to reduce the risk of tipping and spillage, temporary sanitary facilities should be firmly anchored to the ground and located where they are protected from high winds.
- Temporary sanitary facilities should be located a minimum of 50 feet away from drainage facilities, watercourses and traffic circulation. Avoid locating sanitary facilities on an impervious surface. Secondary containment may be required for sanitary facilities located on impervious surfaces.
- Wastewater must not be discharged onto or buried within the construction site.
- If sanitary and septic systems discharge directly into sanitary sewer systems, where permissible, the contractor needs to comply with applicable city, county or sewer district requirements. Use of portable toilet facilities on the construction site may require a permit from the local municipality or health department.
- If using an on-site disposal system, such as a septic system, the contractor may need to comply with county health department requirements.
- Properly connect temporary facilities that discharge to the sanitary sewer system to avoid illicit discharges.
- Ensure sanitary and septic facilities are maintained in good working order. It is recommended that a licensed contractor be used or consulted.
- It is recommended to use reputable, licensed sanitary and septic waste haulers.

Maintenance, Inspections and Removal

- Inspect all sanitary waste management devices weekly and after each rainfall event that results in stormwater runoff – and as strong wind conditions occur. Discuss maintenance issues and requirements with the sanitary facility provider before installation.
- Make sure routine and timely disposal of waste materials is occurring.
- Respond immediately to correct problems caused by damage to or tipping of portable units. Clean up and dispose of spills in accordance with state and local regulations. Determine response times for waste haulers and adjust the callout routine to ensure timely disposal of waste is occurring.

- Anticipate fluctuations in facility usage based on the number and location of concurrent construction activities as well as variations in the total number of workers present on the site. Relocate facilities, add units, or increase the frequency of maintenance calls to waste haulers as necessary to make sure the units are convenient for use and do not overfill.
- Remove this temporary device and stabilize the site prior to filing [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 (see [Chapter 1 -Missouri Permit Requirements](#)) for termination of permit coverage.

Common Problems and Solutions

Problem	Solution
Waste management device falls over or is blown over by wind, caused by improper anchoring.	Anchor or otherwise tie down the device securely.
The sanitary or septic system facility is overflowing, caused by failure to routinely empty and dispose of the waste.	Call the sanitary facility provider to empty the waste immediately and dispose of it properly. Ensure the person in charge of the facility is clearly aware of their responsibility to oversee proper inspection and maintenance. Implement additional education for all involved.

Petroleum and Hazardous Waste Management



Figure 6.19 This site has a designated vehicle maintenance area with all petroleum products located within secondary containment areas. Source: BFA, Inc.

Petroleum and hazardous wastes must be managed and controlled on a construction site to ensure they do not contaminate the stormwater flow and discharge from the site. The site superintendent and field personnel must ensure proper management of petroleum and hazardous waste by providing secondary containment of petroleum and hazardous substances, and by ensuring proper use, containment and disposal. Site superintendents and field personnel should strive to reduce, reuse and recycle materials as much as possible and avoid purchasing, storing and using more petroleum and hazardous waste material than necessary.

While this is a guidance document, some of the information in this section might actually be required under federal, state or local regulations. The general contractor and site superintendent need to ensure they have a clear understanding of federal, state and local requirements, and they should ensure all field personnel are properly educated and trained in these areas.

Recommended Minimum Requirements

Ensure hazardous waste management practices are implemented on construction projects that generate any waste from the use of:

- Petroleum products.
- Asphalt products.
- Concrete curing compounds.
- Pesticides.
- Acids.
- Paints.
- Stains.
- Solvents.
- Wood preservatives.
- Roofing tar.
- Soil binders
- Any materials deemed a hazardous waste according to federal and state laws and regulations.

More information about federal and Missouri laws and regulations is available on the Missouri Department of Natural Resources' Hazardous Waste Program Web page at www.dnr.mo.gov/env/hwp/lawsregs.htm or by calling 800-361-4827 or 573-751-3176

More information about Kansas laws and regulations is available on the Kansas Department of Health and Environment Web page www.kdheks.gov/waste/ or by calling 785-296-1600.

Documentation

Log all education, maintenance, inspection and removal activities in case questions arise during inspections and for reference when troubleshooting problems.

Education And Training

- Educate employees and subcontractors about potential dangers to humans and the environment from hazardous wastes.
- Train employees and subcontractors about hazardous waste delivery, handling, storage and disposal procedures.
- Instruct employees and subcontractors about:
 - Identification of hazardous and solid waste.
 - Safety procedures for common construction site hazardous wastes.
- Hold regular meetings to discuss and reinforce hazardous waste management procedures along with safety procedures.

Petroleum Products

All vehicles kept on-site need to be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Leaking vehicles and construction equipment should be removed from service until the problem has been corrected. Petroleum products should be stored in tightly sealed containers are clearly labeled. Any asphalt substances used on-site should be applied according to the manufacturer's specifications and recommendations. Empty containers should be disposed of per manufacturer's recommendations and meet all federal, state and local regulations.

Fueling and Servicing

No fueling, servicing, maintenance or repair of equipment or machinery should be done within 100 feet of a stream, or within 150 feet of a classified stream, losing stream or sinkhole. Tarps or drop cloths and drip pads should be used when servicing, repairing or performing maintenance on construction equipment in the field. When work is complete, the contaminated materials should be disposed of appropriately.

Disposal of Petroleum and Hazardous Materials

No fuels, oils, lubricants, solvents, coolant, washer fluid or other hazardous materials can be disposed of on-site. All hazardous material must be properly disposed of in accordance with State law.

- For guidance, contact 800-361-4827 in Missouri or 785-296-1667 in Kansas.

Setup, Storage, Maintenance, Inspection and Removal

- Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and under cover in secondary containment.
- Incompatible materials, such as chlorine and ammonia, must not be stored in the same temporary containment facility.
- The site superintendent should keep an accurate, up-to-date inventory of material delivered and stored on-site.
- Minimize material inventory when stored on-site (e.g., only a few days supply).
- Employees trained in emergency spill clean-up procedures need to be present when dangerous materials or liquid chemicals are unloaded.
- Locate temporary storage areas away from vehicular traffic and in upland areas.
- Spill containment is highly recommended for chemical storage and transfer areas. (See [Spill Prevention and Control](#)).
- Locate an ample supply of appropriate spill clean-up materials near storage areas.
- Keep storage areas clean, well organized and equipped with ample clean-up supplies as appropriate for the materials being stored.
- Post proper storage instructions at all times in an open and conspicuous location. Storage areas should be clearly marked, directing placement of containers and materials.
- Store materials in their original containers. Maintain original product labels on the container where they can be easily seen. Damaged or otherwise illegible labels should be replaced immediately.
- Store bagged and boxed materials on pallets. Do not allow materials to accumulate on the ground. Cover bagged and boxed materials during non-working days and prior to rain events.
- Store materials exposed to precipitation in watertight, structurally sound, closed containers. All chemicals should be stored in approved containers and not exposed to stormwater.

Secondary Containment

Materials such as fuel (e.g., gasoline, diesel, kerosene), oil products (e.g., motor oil, transmission fluid, hydraulic oils, grease), miscellaneous liquids (e.g., windshield washer fluid, antifreeze, paint, concrete cure, liquid fertilizer, concrete sealer, calcium chloride, salt brine) should be stored in secondary containment. This represents a partial list.

- Throughout the rainy season, each secondary containment facility should have a permanent cover. The facility should at least be covered during non-working days, prior to rain events and during rain events. The cover should include side wind protection. The cover should be securely fastened to be effective during all rain events, overnight and during any extended period of time when the site will be left unattended.

- No not allow rainwater to collect within the secondary container. Remove any rainwater waste that does collect within the structure immediately so it does not reduce the capacity to contain spills or leaks. Collect and properly dispose contaminated rainwater, spills and leaks in accordance with local, state and federal regulations. (See [Spill Prevention and Control](#)).
- Provide Adequate cover to the secondary container to prevent the entry of rainwater. Depending on the type of secondary container used, adequate cover could include a tarpaulin, fitted lid or roof.
- Provide a temporary containment facility for a volume able to contain precipitation from a 24-hour, 25-year storm event, plus the greater of 10 percent of the aggregate volume of all containers or 100 percent of the capacity of the largest container within its boundary, whichever is greater.
- A temporary containment facility should be impervious to the materials stored therein for a minimum contact time of 72 hours.

Provide sufficient separation between stored containers, secondary or otherwise, to allow for spill cleanup and emergency response access. (See [Spill Prevention and Control](#)).

Inspection

- Inspect all construction equipment prior to use each day for leaks or spills.
- Inspect all areas where petroleum and hazardous waste materials are stored.
 - Inspect weekly and after each rainfall event that results in stormwater runoff.
 - Repair or replace perimeter controls, containment structures, covers and liners as needed to maintain proper function.
- Collect and clean up spills, leaks or accumulated rainwater and dispose of appropriately.
- If a rain event causes secondary containment devices to fill with water, dewater the containment system in the appropriate manner.
- Make sure routine and timely disposal of waste materials occurs.

Removal

- Collect, remove and dispose hazardous waste only at authorized disposal areas.
- Remove and stabilize petroleum and hazardous materials stored on the construction site prior to filing [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 (See [Chapter 1 -Missouri Permit Requirements](#)) for termination of permit coverage.

Common Problems and Solutions

Problem	Solution
Temporary containment device is full or overflowing after a rain event due to failure to dewater or lack of adequate storage volume.	Contain the discharge and ensure it does not leave the site. Ensure dewatering occurs in a timely manner following storm events. If necessary, enlarge the containment system to allow additional storage volume, and maintain the system appropriately.
Sheen shows up in dewater discharge, due to failure to remove sheen prior to dewatering.	Ensure there is no visible sheen on rainwater prior to dewatering. Use appropriate absorbents to recover materials to the extent possible. Properly dispose of absorbent materials and then finish dewatering.

Spill Prevention and Control

Spill prevention and control procedures and practices are necessary to prevent and control spills in a manner that minimizes or prevents the discharge of spilled material to the drainage system or watercourses. This includes calling the spill hot line to report the spill.

It is not the intent of this guidance to supersede or replace normal site assessment and remediation procedures concerning hazardous materials. (See [Petroleum and Hazardous Waste Management](#)). Significant spills, releases or contamination warrant an immediate response by trained professionals.

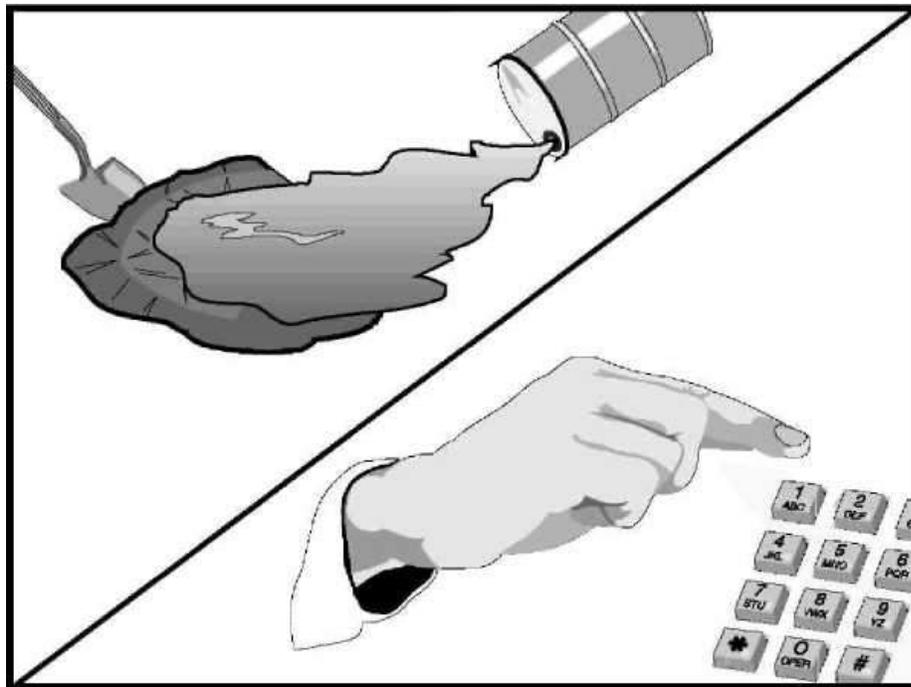


Figure 6.20 Contain spills and report them to the appropriate agency .

In Missouri, contact the department's emergency spill hot line at 573-634-2436.
In Kansas, contact the KDHE 24-hour spill hotline at 785-296-1679.

Recommended Minimum Requirements

Documentation

Log all education, maintenance, inspection, clean up and removal activities in case questions arise during inspections and for reference when troubleshooting problems.

Education and Training

- Ensure the contractor provides adequate training to the site superintendent and all field personnel about the proper protocol for reporting and cleaning up spills.
- Educate employees and subcontractors about potential dangers to humans and the environment from spills and leaks.
- Educate employees and subcontractors about what a “significant spill” is for each material they use and what is the appropriate response for “significant” and “insignificant” spills.
- Hold regular meetings to discuss and reinforce appropriate disposal procedures. Incorporate disposal procedures into regular safety meetings.
- Establish a continuing education program to train new employees.

In addition to good housekeeping and material management practices listed previously, the following practices need to be followed for spill prevention and clean-up:

- The spill response plan should be documented and its availability should be referenced in the written stormwater pollution prevention plan or SWPPP.
- Clearly post methods on-site for storage and spill cleanup, including manufacturer’s recommendations.
- Make site superintendent and field personnel aware of the procedures and the location of material safety data sheets, or MSDSs, information and cleanup supplies. For federal requirements for Spill Controls and Countermeasure Plans, or SPCC, see 40 CFR Part 112 on the Web at www.campuserc.org/virtualtour/grounds/WasteOils/Pages/SPCCDetails.aspx.
- Keep material and equipment necessary for spill cleanup in the material storage area on-site. Equipment and materials include, but are not be limited to, brooms, dust pans, mops, rags, gloves, goggles, kitty litter, sand, sawdust and plastic and metal trash containers specifically for this purpose.
- Clean up all spills immediately after discovery and properly containerize spills for proper disposal. Burial is not acceptable.
- Keep the spill area well ventilated. Personnel need to wear appropriate protective clothing to prevent injury from contact with a hazardous substance.

Reporting

Spills of toxic or hazardous material must be reported immediately to the appropriate state or local government agency, pursuant to reportable quantity regulations for specific materials or if a waterway is, or may be, impacted. Each county should have a Local Emergency Planning Committee, or LEPC. If you are unable to contact the committee directly, contact your local fire department, city hall or county courthouse. When permits are applicable, the permittee or authorized representative is required to notify the Missouri Department of Natural Resources or Kansas Department of Health and Environment’s Environmental Emergency Response in accordance with 40CFR117 and CFR302 as soon as they have knowledge of the discharge of any hazardous substance or petroleum product in excess of the reportable quantity.

- In Missouri, contact the 24-hour emergency spill hotline at 573-634-2436.
- In Kansas, contact the 24-hour emergency spill hotline at 785-296-1679.

In Missouri, state law requires the responsible party (spiller) to report petroleum product releases greater than 50 gallons to the Missouri Department of Natural Resources at 573-634-2436 at the earliest practical moment after discovery. If the release is from an underground storage tank, or UST, or piping, the reportable quantity is 25 gallons or more. Reports are also required for above ground storage tanks, or AST, that have released 50 gallons or greater. Further, federal law requires the responsible party to report any release of oil if the oil reaches or threatens any waterway. The definition of waterway includes sewers, groundwater, wetlands, lakes, creeks, streams, rivers and areas that may not have running water in them at the time, such as road ditches that drain into other waterways.

Adjust spill prevention plan to include measures to prevent this type of spill from being repeated. The plan needs to show how to clean up the spill if another one does occur.

Hazardous Products

- Keep products in original containers unless they are not resealable. If product is transferred to a new container, mark and label properly.
- Retain original labels and material safety data sheets. (See [Petroleum and Hazardous Waste Management](#)).

Disposal

If surplus product or a container must be disposed of, disposal must be done in accordance with State law. For local disposal information, contact your solid waste district, your local emergency planning committee or:

- In Missouri call 800-361-4827.
- In Kansas call 785-296-1667.

Maintenance, Inspections and Removal

- Inspect spill kits on a weekly basis and after each rainfall event that results in stormwater runoff. Inspect the spill kit anytime after material from the kit is utilized and note what material will need to be replaced.
- Maintain the appropriate contents of the spill kit as necessary. List contents of spill kit and attach it to the underside of the spill kit lid or some other readily accessible location. Include on the list the name and phone number of the person or company to contact to replace spill kit items.
- Remove this temporary device and stabilize the site prior to filing [Form H - Request for Termination of a General Permit](#), Form--MO 780-1409 (See [Chapter 1 -Missouri Permit Requirements](#)) for termination of permit coverage.

Common Problems and Solutions

Problem	Solution
Spills are not handled properly, due to site personnel being unaware of spill kit or its location.	Educate all contractors and subcontractors as they begin work on the site. Ensure they know the location of the spill kits and how to use them.
Spill went undetected for a significant period or was not reported, caused by lack of education, lack of inspections or inattention.	Educate all site personnel that all spills are to be reported to the site superintendent immediately and the spill should be contained and cleaned up immediately. Ensure all site personnel are properly trained.

Emergency Numbers

- **In Missouri:** Contact the department's emergency spills hotline at 573-634-2436. More information about federal and Missouri laws and regulations is available on the Missouri Department of Natural Resources' Hazardous Waste Program webpage at www.dnr.mo.gov/env/hwp/lawsregs.htm or by calling 800-361-4827 or 573-751-3176
- **In Kansas:** Contact the department's 24-hour spill hotline at 785-296-1679. More information about Kansas laws and regulations is available on Kansas Department of Health and Environment webpage at www.kdheks.gov/waste or by calling 785-296-1600

Dust Control and Air Emissions

Prohibited Open Burning Under State Regulations

In Missouri, any waste generated by a business, trade, industry, salvage or demolition operation cannot be burned without a permit issued by the Department of Natural Resources or its delegated local agency. Permits will only be considered for untreated wood wastes. Wastes that may not be burned include but are not limited to tires, rubber products, hazardous materials, styrofoam, plastics, petroleum based products, demolition waste, treated wood and any asbestos containing material.

Required Open Burning Permits

In Missouri, the open burning of certain trade wastes, primarily untreated wood wastes such as pallets or crates, throughout the state, and vegetation from land clearing operations in the Springfield-Greene County area and the Kansas City and St. Louis Metropolitan areas, may be permitted only when it can be shown open burning is the only feasible method of disposal and disposal is in the public interest. In the St. Louis nonattainment area, permits will not be issued unless it can be shown emissions from open burning would be less than any other waste management or disposal method. The open burning permit requires the facility, in most cases, to use an air curtain destructor.

For more information in Missouri contact the Missouri Department of Natural Resources at 800-361-4827, or:

- Contact your nearest Missouri Department of Natural Resources' Regional Office. Contact information located on the Web at www.dnr.mo.gov/regions/regions.htm.
- See *Facts on Open Burning Under Missouri Regulations* fact sheet at www.dnr.mo.gov/pubs/pub2047.pdf.
- Visit the Missouri Department of Natural Resources' Air Pollution Control Program website at www.dnr.mo.gov/env/apcp/publications.htm or call 573-751-4817.
- Visit the Missouri Department of Natural Resources' Solid Waste Management Program webpage at www.dnr.mo.gov/env/swmp/index.htm, or call 573-751-5401.

In Kansas, open burning is regulated by the Kansas Department of Health and Environment. Any open burning of tree and brush typically requires a permit. For more information:

- *Open Burning of Wood Waste* - Technical Guidance Document BAR2000-01.
- *Open Burning for Tree and Brush Sites* - Technical Guidance Document 2002.
- Technical Guidance Document (burning of waste).

For more information in Kansas, contact your Kansas Department of Health and Environment district office, or call 785-296-1550.

Note: Local governments may have stricter laws and policies regarding burning or disposal of wastes.

Dust Control Regulations

In Missouri, state regulation places limits on the amount of visible dust that can leave a property boundary. The general contractor is responsible for implementing control measures as necessary when handling, transporting or storing any material; construction, repair, cleaning or demolition of a building or its appurtenances; construction of use of a road, driveway or open area; or operation of a commercial or industrial installation without applying reasonable measures to prevent visible dust from leaving the property boundary.

For more information about this regulation:

- See 10 CSR 10-6.170 Restriction of Particulate Matter to the Ambient Air Beyond the Premises of Origin at www.sos.mo.gov/adrules/csr/current/10csr/10csr.asp.
- Visit the Missouri Department of Natural Resources' Air Pollution Control Program website at www.dnr.mo.gov/env/apcp/publications.htm or call 573-751-4817.

Dust control measures used to protect air quality must not cause a violation of the water quality standards, permit conditions or other regulations. For more information about dust control measures, see [Surface Stabilization – Erosion Controls](#).

General Housekeeping Reminders

Some general reminders of information provided in this pollution prevention and good housekeeping section, include:

- An effort should be made to store only enough product to do the job. All materials stored on-site should be stored in a neat, orderly manner in their appropriate containers and, if applicable, under a roof or other enclosure.
- Products should be kept in their original containers with the original manufacturer's label. If a replacement container is used, it must be clearly labeled and the original label retained.
- Whenever possible, all of a product should be used up before disposing of the container.
- Manufacturer's recommendations for proper use and disposal of contents and containers must be followed. Refer to the [Material Safety Data Sheets](#).
- The site superintendent should inspect daily to ensure proper usage, storage and disposal of materials.
- Fertilizers need to be applied only in the minimum amounts recommended by the manufacturer.
- All paint containers need to be tightly sealed and stored when not required for use. Excess paint may not be dumped into the storm sewer system but should be properly disposed of according to manufacturer's instructions, Material Safety Data Sheets and State and local regulations. (See [Petroleum and Hazardous Waste Management](#)). Non hazardous non bulk household products are allowed by regulation to be disposed of sanitary landfills. However, landfill operators may impose more stringent restrictions. Contact the local government for more information and refer to [Solid Waste Management](#).
- Disposal of waste oil. If used oil has come into contact with hazardous materials, it is considered to be waste oil. It must be disposed of according to hazardous waste regulations. (See [Petroleum and Hazardous Waste Management](#)).
- Used oil (non hazardous) should be disposed of at the nearest used-oil recycling center. For more information, check with the local government and refer to the Missouri Solid Waste Management webpage at www.dnr.mo.gov/env/swmp/index.html or call 800-361-4827.
- Mudtracking is a common problem at construction sites. Refer to [Site Preparation](#) for proper exit pad installation and maintenance.

SECTION 3: SURFACE STABILIZATION - EROSION CONTROLS

Temporary Seeding



Figure 6.24 Temporary vegetation is a relatively inexpensive way to stabilize construction sites in a hurry. As grass grows, the roots hold soil in place and the plant protects the soil surface from raindrop impacts. Source: N. Klopfenstein, NRCS. St. Charles Co.

Practice Description

Temporary seeding is the establishment of fast-growing annual vegetation to provide economical erosion control for up to 6 months and reduce the amount of sediment moving off the site.

Annual plants that germinate rapidly and survive for only one growing season are suitable for establishing temporary vegetative cover.

This practice applies where short-lived vegetation needs to be established before final grading or in a season not suitable for permanent seeding.

Recommended Minimum Requirements

A qualified professional should specify plant materials, seeding rates and times of planting. The site superintendant and field personnel should refer to plans and specifications throughout the construction process. To ensure emergence, vigorous growth of seedlings and continued plant growth, prepare the seedbed and add soil amendments according to soil tests. Protect the soil and seed with mulch or other erosion control until the vegetation is fully established to a density of 70 percent over the entire vegetated area.

Soil

Make sure there is a minimum of three inches of topsoil with a sufficient percentage of organic material to sustain vegetative growth.

Seedbed Preparation

Loosen soil to depth of 3-inches for broadcast seeding or drilling. If compacted, loosen soils for no till drilling. Avoid excessively wet conditions.

Amendments

Incorporate fertilizer and lime (if soil pH is less than 5.3) incorporated 3- to 6-inches into the soil. See Table 6.2.

Seed Quality

Use certified seed, tested within the past nine months.

Plants

Select recommended temporary erosion control plant species. Rate of application and seeding dates are listed in Tables 6.3 and 6.4.

Erosion Control

Cover the seeded area with approved mulching materials or other erosion control devices to protect the soil and seed until vegetation is fully established.

General

Inspect seeded areas 2 to 4 weeks after seeding for seed germination, vegetation establishment, erosion control and weed control. Repair and reseed as necessary.

Reseed

After six months if the site is not in permanent vegetation over the entire disturbed area to a density that impedes erosion.

Installation

Successful vegetative establishment is directly dependent on the nutrients in the soil. For optimum results, take soil samples from the top 6-inches in each area to be seeded. Submit samples to a soil testing laboratory for liming and fertilizer amendment recommendations.

Seedbed Preparation

- Seedbed preparation is essential for the seed to germinate and grow.
- For broadcast seeding and drilling, loosen the soil to a depth of approximately 3-inches.
- For no-till drilling, the soil surface does not need to be loosened unless the site has surface compaction.
- Use a disk, ripper, chisel, harrow or other acceptable tillage equipment to loosen compacted, hard or crusted soil surfaces. Avoid preparing the seedbed under excessively wet conditions.

Liming

- Acid soils with an extremely low pH can prevent seeding success. However, most of the recommended temporary vegetation is tolerant of low pH soils and will establish on all but the lowest pH soils.
- If soil pH in the region is known to be extremely low, conduct a soil pH test to determine if limestone is necessary for temporary seeding. Amend soils with lime according to information in Table 6.2. Soils with a pH above 7.0 should not be limed.

Table 6.2 Liming Requirements for Temporary Sites

pH Test	Plant Response	Recommended Application of Agricultural Limestone
Below 6.0	Poor growth	Lime according to soil test
6.0 - 6.5	Adequate growth	No lime recommended
Greater than 6.5	Optimum	No lime recommended

Fertilizer

- The soil will most likely be deficient in nutrients required for growth. A soil test will provide the best guide for the amount and types of fertilizer to apply for optimum plant growth.
- A general recommendation is to broadcast Nitrogen, Phosphorus and Potassium at 90 lbs./acre for areas receiving more than 30 inches of precipitation and 50 lbs./acre in areas receiving less than 30 inches of precipitation.

For example, to compute the bulk pounds of product to use - For 100 pounds of a 10-10-10 fertilizer mix you have 10 percent or 10 pounds of actual Nitrogen, Phosphorus and Potassium. The remaining 70 percent or 70 pounds of product in the bag is inert material that improves application consistency. You would need to apply 900 pounds of product per acre to provide 90 pounds of actual Nitrogen per acre.

- For best results incorporate the fertilizer into the top 3- to 6-inches before seeding.

Seeding

- Apply seed evenly with a broadcast seeder, drill, cultipacker seeder or hydroseeder. Plant small grains no more than 1½ inches deep. Plant grasses and legumes no more than ½ inch deep.
- Prior to mulching, harrow, rake or drag a chain to lightly incorporate broadcast seed into the soil to enhance germination. Cover applied seed with mulch (See [Mulching](#)).

Table 6.3 Temporary Seeding Plant Materials and Minimum Seeding Rate *

Species	Seeding Rate		Plant Characteristics
	lbs. per Acre	lbs. per 1,000 ft. ²	
Oats	80 lbs.	2 lbs	Not cold tolerant, height up to 2 feet
Cereals: Rye/Wheat	90 / 120	2 / 2.5	Cold tolerant, height up to 3 feet, low pH tolerant
Millet, Sudangrass	45 / 60	1 / 1.25	Warm season annual, aggressive growth, height up to 5 feet
Annual Ryegrass	75	2	May be added to mix, not heat tolerant, height up to 16 inches
Annual Lespedeza** plus Tall Fescue	15 plus 45	0.5 plus 1	Warm season annual legume, makes own nitrogen, tolerated low pH

* In areas receiving less than 30 inches of precipitation, use 75 percent of these rates.

** If there is any possibility the seeding will be required to control erosion for more than one year, then consider the addition of fescue or another permanent species as part of a mixture when seeding.

Planting Dates

- Plant according to the design plan. In absence of a plan, choose a recommended temporary species or mixture appropriate for the season from Tables 6.3 and 6.4.
- Plant during optimum seeding dates if at all possible. Always use mulch or other erosion control practices to cover and protect seed and soil during vegetation establishment. Roll and cultipack broadcast seed for good soil-to-seed contact.
- Use high quality seed and for best results, use certified seed. When using uncertified seed, use the highest recommended seeding rate.

Table 6.4 Seeding Dates for Temporary Seeding

Species	Seeding Dates Optimum and Acceptable											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oats												
Cereals: Rye/Wheat												
Millet, Sudangrass												
Annual Ryegrass												
Annual Lespedeza plus Tall Fescue ¹												

¹ If site may not be developed within one year, consider permanent species listed in Table 6.5.

Table Key	
	Optimum Seeding Times
	Acceptable Seeding Times

Mulching

- Mulching conserves moisture and reduces erosion during seed germination and vegetation establishment.
- Evenly cover a minimum of 75 percent of the ground surface with mulch material specified in the design plan. Tack or tie down the mulch according to plan (See [Mulching](#)).

Construction Verification

Check materials and installation for compliance with specifications.

Maintenance and Inspection

- Check temporary seeding during each weekly inspection to monitor germination, growth and to see if stands are of adequate thickness (more than 70 percent density of the ground surface vegetation over the entire area to be stabilized). Stands should be uniform and dense for best results. Fertilize, reseed and mulch bare and sparse areas immediately to prevent erosion.
- Mowing is not recommended for cereals seeded alone. Cereals seeded with a grass can be mowed when height is greater than 12-inches. However, to prevent damage to grasses, do not mow shorter than 4-inches.
- Mow millets and sudangrass before height is greater than 6-inches to allow regrowth and continued erosion protection.
- Annual lespedeza and tall fescue may be mowed after height exceeds 8-inches. Do not mow shorter than 4-inches.
- Replant temporary or permanent vegetation within 12 months as annual plants die off and no longer provide erosion control (see [Permanent Seeding](#)). Consider no-till planting

where possible.

Common Problems and Solutions

Problem	Solution
Design specifications for seed variety, seeding dates or mulching cannot be met.	Substitutions may be required. Unapproved substitutions could lead to failure.
Vegetation is not sustainable as a permanent cover caused by a lack of topsoil resulting in a lack of organic material, nutrients and water holding capacity.	Add topsoil with a minimum of three percent organic material.
Poor seedling emergence and growth with erosion of the soil caused by inadequate seedbed preparation.	Repair gullies, prepare seedbed, fertilize, lime (if necessary), mulch and reseed.
Unsuitable choice of plant materials; resulting in poor germination or inadequate stand (less than 70 percent of the ground surface covered).	Choose plant materials appropriate for season, prepare seedbed and replant.
Poor or spotty stands of vegetative cover caused by inadequate mulching, washing away of the seed and erosion of the soil surface.	Poor plant vigor, yellow color and short height caused by a lack of nitrogen - add 50 lbs. of nitrogen fertilizer per acre. Do not apply over the top of existing plants from June 1 to Aug. 15 or on frozen ground.
Poor plant vigor, yellow color and short height caused by a lack of nitrogen.	Add 50 lbs. of nitrogen fertilizer per acre. Do not apply over the top of existing plants from June 1 to Aug. 15 or on frozen ground.
Dying plants caused by a lack of topsoil or soil compaction that limits root growth and water availability to plants.	Add organic material and loosen soil if reseeding is necessary or before seeding permanent vegetation.

Permanent Seeding



Figure 6.25 Permanent vegetation can be used to stabilize many structures, such as this grassed waterway, ensuring that runoff is relatively sediment-free.

Practice Description

Permanent seeding is the establishment of perennial vegetation on disturbed areas for periods longer than 12 months. Permanent vegetation provides economical long-term erosion control and helps prevent sediment from leaving the site. This practice is used when vegetation is desired to permanently stabilize the soil or if future phases of a construction site will remain dormant for a significant period of time after grading. It is necessary to protect earthen structures such as dikes, channels and embankments. Particular care is required to establish a good, thick cover of permanent grass.

Recommended Minimum Requirements

A qualified professional should specify plant materials, seeding rates and times prior to start of construction. The site superintendant and field personnel should refer to plans and specifications throughout the construction process. To ensure germination and growth, prepare seedbed, add soil amendments according to soil tests, mulch all seeded areas and follow the seeding dates.

Seedbed Preparation

For broadcast seeding or drilling, loosen soil to depth of 3-inches. For no till drilling, loosen the soil if it's compacted. Avoid excessively wet conditions.

Soil Amendments

Incorporate fertilizer and lime (if soil pH is less than 6.0) incorporated 3- to 6-inches into the soil.

Seed Quality

Use certified seed, tested within the past 9 months.

Planting Dates

Coordinate the construction schedule with planting dates appropriate for region and species (See Table 6.5).

Plants

Select from recommended erosion control plants (grass or grass/legume mixtures) as shown in Tables 6.5 and 6.6. Rate of application and seeding dates are shown in Tables 6.4, 6.7 and 6.8.

Mulch

Cover a minimum of 75 percent of the ground surface with approved material (See [Mulching](#)).

Inspection

Inspect seeded areas during each weekly inspection. Repair and reseed as necessary.

Installation

During final grading, take soil samples from the top 6-inches in each area to be seeded. Submit sample to a soil testing laboratory for liming and fertilizer recommendations.

Seedbed Preparation

- Seedbed preparation is essential for the seed to germinate and grow.
- For broadcast seeding and drilling, loosen the soil to a depth of approximately 3-inches.
- For no-till drilling, the soil surface does not need to be loosened unless the site has surface compaction.
- Loosen compacted, hard or crusted soil surfaces with a disk, ripper, chisel, harrow or other tillage equipment.
- Avoid preparing the seedbed under excessively wet conditions.

Liming

- Follow the recommendations resulting from the soil test. Apply ground agricultural limestone unless a soil test shows a pH of 6.5 or greater.
- Incorporate lime into the top 3- to 6-inches of soil.
- Do not add lime if the pH is 7.0 or greater.

Fertilizer

Remember: Phosphorus helps roots grow and develop to get the grass plants established. Nitrogen will only be taken up after the seed has germinated and the vegetation is growing. It may wash down stream if applied heavily during seeding.

Note: Fertilizer can be blended to meet exact fertilizer recommendations. Take soil test recommendations to local fertilizer dealer for bulk fertilizer blends. This may be more economical than bagged fertilizer.

For establishment and long-term growth, apply a complete fertilizer at rates recommended by soil tests or as specified in the design plan. In the absence of soil tests, use the following as a guide:

- A typical fertilizer blend for lawn grass mixes: Apply 10-24-18 which represents 10 percent of actual nitrogen – 24 percent of actual phosphorus and 18 percent of actual potassium within the fertilizer compound. If you had 100 pounds of a 10-24-18 blend you would have 10 pounds of actual nitrogen, 24 pounds of actual phosphorus and 18 pounds of actual potassium within the bag.

- A typical application rate of fertilizer for initial establishment of vegetation after seeding is approximately 1 pound of actual nitrogen per 1,000 square feet. With the 10-24-18 fertilizer this would require the application of approximately 435 pounds of this fertilizer mix per acre since there are 43,500 square feet in an acre. This fertilizer would also provide more than 2 pounds of phosphorus per acre.
- Incorporate lime and fertilizer to a depth of 3- to 6-inches by disking or chiseling on slopes of up to 3:1.
- Grade soil to a smooth firm surface to enhance rooting of seedlings and reduce rill erosion.
- Subsequent fertilization with an additional 2 pounds per 1,000 square feet of actual Nitrogen approximately one month after initial seeding will help grass growth after germination to achieve the density of vegetation to prevent or minimize erosion. A typical fertilizer for a second application once vegetation is established would be a 20-10-5 mix at 435 pounds of fertilizer per acre.

Plant Selection

If not specified in the design plan, choose a suitable species of grass or a grass/legume mixture from Tables 6.5 and 6.6 appropriate for the season. Consider site conditions including soils, plant characteristics, region of the state and desired level of maintenance. The species shown are adapted for lawns and erosion control. If there are questions on species selection and how they may be adapted in wildlife habitat or wetland applications, contact your local Natural Resources Conservation Service or Extension office.

Developing a Mixture

A pure stand of grass provides the best erosion control. The advantage of a grass/legume mix is the legume provides nitrogen to the grass and often grows during hotter and drier months when the grass is dormant. Usually one grass and one or two legumes is sufficient in a mixture. More grasses can be mixed together, but may be of little use. Refer to Tables 6.5 and 6.6 for information about each grass and legume to determine the correct species for your site.

Nurse Crops (Temporary or Annual Species)

Nurse crops are temporary grains that have one growing season such as wheat, rye and oats and are sometimes used in a seeding mixture. These annuals can reduce weeds, control erosion and provide protection to young seedlings until the perennial species become established.

Plant nurse crops about 1-inch deep. Most permanent grasses and legumes are sown 1/4 inch deep. Permanent seedings should not be planted deeper than 1/4 to 1/2 inch.

Aesthetic Plantings

A wide variety of native forbs and grasses are available that add diversity and beauty to permanent plantings (e.g., switchgrass as an accent). Contact your local Natural Resources Conservation Service office for species selection and seeding rates.

Planting Dates

If seeding dates are not specified in the design plan or construction has not proceeded according to schedule, use the seeding calendar shown in Table 6.5.

Plant during optimum seeding dates if at all possible. Always use mulch or other erosion control measures to protect the seed and reduce erosion until the vegetation is established. For dormant seeding dates, broadcast seed and immediately roll and cultipack for good soil-to-seed contact.

If unable to seed according to schedule, use temporary seeding until the preferred date for permanent seeding.

Seeding Rates

If seeding rates are not specified in the design plan, use rates in Table 6.8 for grasses alone. Use rates in Table 6.9 for a grass or legume mixture. These rates are based on the poor growing conditions that typically exist on a development site, a need for dense growth and high germination rates.

For best results use certified seed. When using uncertified seed, use the highest recommended seeding rate. Higher seeding rates will not substitute for good seedbed preparation.

- Apply seed uniformly using a cyclone seeder, drop-type spreader, drill, cultipacker seeder or hydroseeder.
- When using a drill seeder, plant rye or other grains about 1-inch deep; plant grasses and legumes no more than ½ inch. Calibrate equipment in the field.
- Cover seed by raking, or dragging a chain, brush or mat. Then firm the soil lightly with a roller. Seed can also be covered with hydro-mulched wood fiber and tackifier or a rolled erosion control product.
- Legumes require inoculation with nitrogen-fixing bacteria to ensure good growth. Purchase inoculum from seed dealer and mix with seed prior to planting.

Table 6.5 Planting Dates Optimum and Acceptable* Planting Dates

Species	Seeding Dates Optimum and Acceptable											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Turf Fescue												
Tall Fescue												
Kentucky Bluegrass												
Perennial Ryegrass												
Ryetop												
Reed Canary												
Bermuda - Common												
Bermuda- Hybrid												
Buffalograss ¹												
Zoysia ²												
Birdsfoot Trefoil												
Common Lespedeza												
Red Clover												
White Clover												
Wheat/Rye ³												
Oats ^{3,4}												

¹ Can also be sprigged.

² Usually sprigged. Space plugs every 6-, 8- or 12-inches; with 4,000, 2,250 or 1,000 sprigs/1000 ft² respectively.

³ Check with your local Noxious Weed Department before planting.

⁴ Nurse crop only.

⁵ Provides a quick temporary cover or nurse crop even if planted in the fall.

Table Key	
	Optimum Seeding Times
	* With Mulch Cover - Acceptable Seeding Times

Table 6.6 Plant Characteristics

	Species	Kansas Adaptation	Missouri Adaptation	Maintenance	Fertility Needs	Establishment Ease
				L - M - H	L - M - H	P - M - G
Cool Season Grasses	Perennial ryegrass	E, C, W*	N, S	L	M	M
	Canada wildrye	E, C, W	N, S	M	L	G
	Tall fescue	E, C, W*	N, S	M	L - H	G
	Crested wheatgrass	E, C, W	N	M	L	M - G
	Kentucky bluegrass	E, C, W*	N, S	H	M - H ¹	M - G
	Bromegrass	E, C, W*	N, S	M	M - H ¹	M - G
	Redtop	S ¹ / ₂ E	N, S	L	L	M
	Reed canary ¹	E, C, W*	N, S	H	L - M ³	P
Warm Season Grasses	Common Bermuda	E, C, W*	S	L	L - M	M
	Hybrid Bermuda	E, C, W*	-	L	L - M	M
	Buffalograss ³	E, C, W*	N, S	L	L	M
	Blue grama	E, C, W*	N, S	L	L	M
	Zoysia ⁴	E, C, W*	-	M	M - H	M
	Sideoats grama	E, C, W*	N, S	M	L	G
	Little bluestem	E, C, W*	N, S	M	L	M
	Big bluestem	E, C, W*	N, S	M	L	M
	Indiangrass	E, C, W*	N, S	M	L	M
	Switchgrass	E, C, W*	N, S	M	L	M
Legumes ⁵	Birdsfoot trefoil	E, C, W*	N, S	L	M	P - M
	Crownvetch	E, C, W*	N, S	M	M	P - M
	Annual lespedeza ⁶	E, C, W*	N, S	M	M	P - M
	Red clover	E, C, W*	N, S	M	M	G
	White clover	E, C, W*	N, S	L	M	M - G
	Alfalfa	E, C, W*	N, S	M	L	P
Companion Crops/Cereal Grains	Wheat	E, C, W*			M	M
	Rye (cereal)	E, C, W*			M	M
	Oats	E, C, W*			M	M

* Adaptation limited to areas that receive additional moisture enhancement by irrigation, subirrigation or overland flow.

¹ Will be high maintenance in lawn – type or low rainfall (<30") settings.

² Adapted to shorelines, wet or frequently flooded areas.

³ Responds well to fertilizer, but doesn't necessarily require it.

⁴ Usually seeded, by can be sprigged.

⁵ Usually sprigged, plugged or sodded.

⁶ Legumes alone will not provide adequate erosion protection: use with a grass in a mixture.

⁷ Will reseed each year if not mowed until after seed shatter in September.

Table Key

L = low
M = moderate,
H = high.
P = poor,
G = good.

Table 6.7 Species Tolerance for Environmental Conditions

Species		Tolerance				
		Shade	Drought	Flooding	Traffic	Soil Wetness
Cool Season Grasses	Perennial ryegrass	L	L	M	M	M
	Canada wildrye	M	M	L	M	P
	Tall fescue	M	M	M	M	P
	Crested wheatgrass	L	H	M	M	G
	Kentucky bluegrass	L	L	M	H	G
	Bromegrass	L	M	L	H	M
	Redtop	L	L	M	H	G
	Reed canary	L	M	H	H	G
Warm Season Grasses	Common Bermuda	L	H	H	H	M
	Hybrid Bermuda	L	H	H	H	M
	Buffalograss	L	H	H	H	G
	Blue grama	L	H	L	M	P
	Zoysia	L	H	M	H	P
	Sideoats grama	L	H	M	H	M
	Little bluestem	L	H	L	L	P
	Big bluestem	L	H	M	L	M
	Indiangrass	L	M	L	M	P
	Switchgrass	L	M	M	M	G
Legumes ¹	Birdsfoot trefoil	L	H	L	M	G
	Annual lespedeza	L	L	M	L	M
	Red clover	L	L	L	M	P
	White clover	L	L	L	H	M
	Alfalfa	L	L	L	L	P

1 Legumes alone will not provide adequate erosion protection: use with a grass in a mixture.

Table Key
L = Low
M = Moderate
H = High
P = Poor
G = Good

Table 6.8 Seeding Rates

Species		Kansas: Full Seeding Rate ¹	Missouri: Full Seeding Rate ¹
		lbs./acre (PLS) ²	lbs./acre (PLS) ²
Cool Season Grasses	Perennial ryegrass	150	150
	Canada wildrye	21	24
	Tall fescue	150	150
	Crested wheatgrass	20	16
	Kentucky bluegrass	120	120
	Bromegrass	100	100
	Redtop	8	8
	Reed canary ¹	40	40
Warm Season Grasses	Common Bermuda	2	4
	Hybrid Bermuda	20 bu./acre	-
	Buffalograss ³	8 (grain)	8 (grain)
	Blue grama	3	6
	Zoysia ⁴	20 bu./acre	-
	Sideoats grama	15	15
	Little bluestem	9	13
	Big bluestem	17	16
	Indiangrass	12.5	16
	Switchgrass	8	9
Legumes ⁵	Birdsfoot trefoil	5	10
	Annual lespedeza ⁶	14	16
	Red clover	8	12
	White clover	3	4
	Alfalfa	9	9
Companion Crops	Wheat	1 bu./acre	1 bu./acre
	Rye (cereal)	1 bu./acre	1 bu./acre
	Oats	1.5 bu./acre	1.5 bu./acre

¹ Note: Rates based on typical construction site conditions where seedbed is normally less than ideal. Planned future use or specific site conditions may dictate an increase or a decrease in rates. Contact your local Natural Resources Conservation Service office or consulting agronomist for specific seeding rates within your county.

² PLS or Pure Live Seed = the amount of seed guaranteed to grow.

³ Legumes alone will not provide adequate erosion protection: use with a grass in a mixture.

Table 6.9 Example Seeding Mixtures for Critical Area Seeding

Grass - Legume Mixture	Seeding Rate (PLS) *	
	lbs./1000 ft. ² ***	lbs./acre
Reed canarygrass / White clover	5 + 0.1	40 + 1
Reed canarygrass / Red clover	5 + 0.25	40 + 2
Tall fescue** / Birdsfoot trefoil	10 + 0.25	80 + 2
Tall fescue** / White clover	10 + 0.1	80 + 1
Tall fescue** / Lespedeza	10 + 0.5	80 + 4
Tall fescue** / Lespedeza / White clover	10 + 0.25 + 0.1	80 + 4 + 1
Tall fescue** / Red clover	10 + 0.25	80 + 2
Tall fescue** / Red clover / White clover	10 + 0.25 + 0.1	80 + 2 + 1
Kentucky bluegrass / White clover	3 + 0.1	25 + 1
Kentucky bluegrass / Red clover	3 + 0.25	25 + 2
Kentucky bluegrass / Birdsfoot trefoil	3 + 0.25	25 + 2
Kentucky bluegrass / Lespedeza	3 + 0.5	25 + 4
Perennial ryegrass / Red Clover	8 + 1	70 + 10
Perennial ryegrass / Birdsfoot trefoil	8 + 0.5	70 + 5
Perennial ryegrass / Lespedeza	8 + 3	70 + 25
Big bluestem / Indiangrass / Switchgrass / Sideoats grama / Western Wheatgrass	-	3.4 + 2.5 + 2 + 3 + 4
Wheat / Rye (as nursery crop)	1.5	60
Oats (as nursery crop)	0.75	30

* PLS or Pure Live Seed = the amount of seed guaranteed to grow. To calculate amount of bulk seed needed: Read seed tag and multiply % purity X % germination = % PLS; then divide lbs of PLS recommended by % PLS. Example: 30 lbs of Reed canary is needed to seed a 1 acre waterway; 90% pure X 90% germination = 81% PLS; 30 lbs PLS / .81 = 37 lbs. bulk seed needed.

** Turf fescue may be substituted for fescue at the same rates.

***Note: Use lbs. / 1,000 ft.² rate to establish dense vegetation for lawns.

Erosion Control

- Mulching or a rolled erosion control product is recommended to conserve moisture, reduce erosion and protect the seed.
- Cover at least 75 percent of the area with approved mulch materials. Crimp, tack or tie down mulch with netting. Mulching is extremely important for successful seeding (See [Mulching](#)).

Construction Verification

Check materials and installation for compliance with specifications.

Maintenance and Inspection

- Inspect seeded areas weekly and after rain events. Check for erosion and seed wash out.
- Expect emergence of grasses and legumes within 28 days after seeding, with legumes following grasses.
- Check permanent seeding at each regular weekly inspection. Look for:
 - Germination.
 - Vigorous seedlings.
 - Uniform density with at least 70 percent of the ground surface covered.
 - Uniformity with nurse plants, legumes and grasses well intermixed.
 - Green, not yellow, leaves. Perennials should remain green throughout the summer, at least at the plant bases.

Reseeding

- Inspect seedings for die out for at least a year. Inspect the soil for erosional areas. To repair bare and sparse areas, fill gullies, refertilize, reseed and mulch. Consider no-till planting where possible.
- If stand is inadequate or plant cover is patchy, identify the cause of failure and take corrective action (e.g., choice of plant materials, lime and fertilizer quantities, poor seedbed preparation, lack of topsoil or weather.) If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or nutrient deficiency is a problem.
- Depending on stand conditions, repair with complete seedbed preparation, then overseed or reseed.
- If it's the wrong time of year to plant desired species, overseed with cereal grain or millets to thicken the stand until timing is right to plant perennials or use temporary seeding.

Fertilization

Satisfactory establishment may require refertilizing the stand in the second growing season.

- Do not fertilize cool season grasses in late May through July.
- Grass that looks yellow may be nitrogen deficient. An application of 500 lbs of 10-10-10 Nitrogen, Phosphorus, and Potassium per acre in early spring will help cool season grasses compete against weeds or grow more successfully.

Remember to convert actual pounds of nutrient needed when determining how many pounds of commercial fertilizer to buy.

- Do not use nitrogen fertilizer if stand contains more than 20 percent legumes.

Mowing

- Consider mowing after plants reach a height of 6- to 8-inches.
- Mow grasses tall, at least 3-inches in height and minimize compaction during mowing process.
- Monitor the late winter and early spring growth of nurse crops to be sure that they do not smother the permanent seeding. Mowing in April may reduce the competitiveness of the nurse crop and open the canopy to allow more sunlight to permanent seedlings that are beginning to grow.
- Vegetation on structural practices such as embankments and grass-lined channels need to be mowed only to prevent woody plants from invading.

Troubleshooting

Consult with design professional if the following occurs:

- Design specifications for seed variety, seeding dates or mulching cannot be met; substitutions may be required. Unapproved substitutions could lead to failure.

Common Problems and Solutions

Problem	Solution
Poor stand of vegetation caused by inadequate topsoil.	Apply good topsoil with a minimum of 5 percent organic material and reseed.
Poor stand of vegetation caused by inadequate seedbed preparation.	Prepare well-tilled, limed and fertilized seedbed and reseed.
Vegetative stand failures caused by unsuitable choice of plant materials such as seeding Bermuda grass in the north or in the fall.	Select an appropriate species based on plant characteristics in Tables 6.8 and 6.9 and time of seeding.
Perennial vegetation overtaken by nurse crop with too high seeding mixture.	Limit rates to those shown in Table 6.9; eliminate old nurse crop, prepare seedbed and reseed.
Inadequate stand of vegetation caused by seeding at the wrong time of the year.	Consult Table 6.5 and reseed. If timing is not right, use temporary seeding to stabilize soil until preferred seeding dates.
Inadequate stand of vegetation, bare spots or eroded areas caused by inadequate mulching.	Prepare seedbed, reseed, cover seed evenly and tack or tie down mulch, especially on slopes, ridges and in channels (see Mulching).

Hydroseeding



Figure 6.26: Hydroseeding over matt armoring on a steep slope to promote vegetation growth and prevent erosion.
Source: *Florida Erosion and Sediment Control Designer and Reviewer Manual*, June 2007

Hydroseeding is the application of a mixture of water, wood fiber (this could be paper or a 70/30 blend of wood fiber and paper), seed, fertilizer, and a soil stabilizer to temporarily and permanently protect exposed areas of soil from erosion due to wind, rain, and runoff. It is a way to establish grass where grass is the desired cover. This method is most often used in large-scale projects such as highway projects or steep slope areas where straw, sod and blankets are more challenging to use.

Hydroseeding is applied with a mechanical machine. Highway departments often use a boom machine with hoses that can shoot up to 100 feet or more, using soil stabilizers in the seed mix.

For most effective coverage, exposed soil surface should be loose (uncompacted) at time of application. Soil areas can be roughened by rolling the surface with a crimping or punching-type roller or by track walking to increase the soil surface area available for seeding. For best results, cover hydroseed layer (seed with soil stabilizer if used) with a mulch layer to keep applied seeds in place, retain soil moisture, and control soil temperature during seed establishment. The mulch acts as a blanket to protect the seed from wind and erosion.

Fertilizers should be included only when soil tests indicate a lack of adequate nutrients to establish and sustain the selected vegetation. However, there is much debate about whether starter fertilizers should be used at time of seeding. The important factor is to have adequate organic matter in the soil bed so that fertilizing is not necessary. Typically by time the seed

germinates and starts to develop a root system, about 25 percent of the fertilizer has leached out or washed away except when one is using a “cross-linked polymer” or so called “water retention polymer”. The other exception is when you are using a growth stimulator that will increase germination therefore allowing more of the starter fertilizer to still be in the soil. There are also other options to using fertilizers, such as guar, biostimulants and other root inoculants.

- The application of a soil binder may be necessary to further stabilize hydraulic mulch and seed to allow for germination and continued growth of vegetation. Soil binders in this case are sold as a tackifier and dust palliative all in one – not soil specific. The soil binder reacts with the soil, binding the mulch, seed, fertilizer, and other additives to the soil, holding it together until vegetation is established. Open weave matting can be applied before hydroseeding areas, especially in areas with steep slopes or sandy conditions, to provide additional structural support, creating a highly erosion-resistant surface to support vegetation establishment. There are also additive products available that have a fibrous material in them to create the same high performance bonding of soil, seed and mulch which is may be cheaper and more efficiently applied through the hydroseeder. See precautions on WCCs under [Chemical Application for Turbidity Reduction](#).

Loading of soil binders and other additives should be done in accordance with machine manufacturer procedures. The hydroseed mix should be applied to the soil as soon as possible following the loading of additives. Otherwise, slurry may become too thick, and the machine could become clogged – wasting time, product and money. Straw, mulch, matting, or jute cover may be applied over the hydroseed application to further promote the vegetation and prevent erosion, but if too thick, the sun, oxygen and water cannot penetrate into the seed/soil.

Installation

- While construction activities are occurring.
- After construction activities are completed.
- Avoid application of hydroseed on existing vegetation, water bodies, sidewalks and roadways. Hydroseeding should not be used in areas where re-disturbance is expected within four to six weeks.
- In a manner that avoids overspray into water bodies, on sidewalks, and on roadways, where the products can end up polluting the water ways.
- Using appropriate hydroseeder equipment.
- Contact the local street department or the state transportation department for more information.

Inspected

- Inspect area at installation to ensure area is properly covered, and receiving waters are properly protected.
- Inspect area after a precipitation event and/or heavy wind for any removal of vegetation, mulch, or other stabilization material.

Maintenance Activities

- Repair coverage and re-apply hydroseed material as needed to maintain maximum protection against erosion.
- If plant seeds fail to germinate, or established plants die, area must be re-seeded. Consult with product distributor or SWPPP preparer for troubleshooting application problems.
- If the desired permanent seeding type is different from the temporary seed, temporary seeding may have to be removed prior to the application of permanent seeding

Common Problems and Solutions

Problem	Solution
In some cases, grass has low germination percentage due to poor contact with soil.	Additives used in hydroseeding can enhance germination and root development, but cautions should be taken to ensure the additives do not make their way to the drainage system.
Hydroseeding application does not cover soil completely and erosion occurs.	Ensure initial application of hydroseeding is done in two directions for proper coverage. Ensure proper products and application rates are used correctly.

Mulch and Hydromulch



Figure 6.27 It takes about two tons per acre of straw mulch to cover at least 75 percent of the ground surface. To prevent erosion and provide the best microclimate for seed establishment, straw mulch should be physically anchored (crimped) or tied down with a tackifier.

Practice Description

Mulch and hydromulch are the application of plant residues such as straw or other suitable materials to the soil surface to reduce erosion. Mulch protects the soil surface from the erosive force of raindrop impact and reduces the velocity of overland flow. It helps seedlings germinate and grow by conserving moisture, protecting against temperature extremes and controlling weeds. Mulch also maintains the infiltration capacity of the soil.

Hydraulic mulch consists of applying a mixture of shredded paper, wood fiber or a hydraulic matrix and a stabilizing emulsion or tackifier with hydroseeding equipment, which temporarily protects exposed soil from erosion by raindrop impact or wind.

Mulch should always be applied to seeded areas to help establish plant cover and protect the seed during establishment.

Recommended Minimum Requirements

Prior to start of construction, mulch requirements should be determined by a qualified professional. The site superintendent and field personnel should refer to plans and specifications throughout the construction process..

Material

As specified in the approved site plan. If not specified, select from mulch materials listed in Table 6.10. Base the choice upon soils, slope steepness and length, flow conditions and time of year (See Figure 6.29).

Coverage

At least 75 percent of the soil surface.

Anchoring

Anchor the light materials, such as hay and straw mechanically using a crimping disc or with hydraulic tackifiers or netting. Heavy material mulches such as wood chips will not require anchoring unless on slopes of 4:1 or greater.

Installation

Site Preparation

- Divert runoff water away from areas above the site that will be mulched.
- Remove large dirt clods, stumps, roots and other debris from the construction area.
- Grade area as needed to permit the use of equipment for seeding, mulching and maintenance. Shape area so it is relatively smooth.
- If the area will be seeded, follow seeding specifications in the design plan (See [Temporary and Permanent Seeding](#)) and apply mulch immediately after seeding.

Mulching

Spread straw or cereal grain mulch uniformly over the area with a power blower or by hand. No more than 25 percent of the ground surface should be visible after spreading.

Apply at the rates shown in Table 6.10. Use higher rates for steep slopes and other erosive areas.

Anchor straw mulch by one of the following methods:

- Crimp with a weighted, straight, notched disc or a mulch anchoring tool to punch the straw into the soil.
- Tack with a liquid tackifier designed to hold mulch in place. Use suitable spray equipment and follow manufacturer's recommendations.
- Cover with netting, using a degradable natural or synthetic mesh to hold mulch materials in more erosive areas. Anchor the netting according to manufacturer's specifications (See [Erosion Control Blankets](#)).
- Anchor wood cellulose mulch with a liquid tackifier.

Figure 6.28 shows straw that has been crimped with a disc blade as in Figure 6.27. Notice when the blade cuts the straw into the soil to anchor it, some of the straw may become vertical and thereby exposing the soil surface to raindrop impact. The vertical straw acts more like a sediment control and you lose some erosion protection. This can be remedied by increasing the amount of mulch used to 3 or 4 tons per acre if crimping will take place. Table 6.10 provides the application rates of different mulch materials.

Use heavy natural nets without additional mulch, synthetic netting with additional mulch or erosion control mats/blankets to control erosion on steep slopes and in areas needing a higher degree of protection such as waterways, swales and diversion channels. These commercial materials vary greatly in longevity, strength, heaviness and the rate of water flow they can handle.

Install netting and mats/blankets according to manufacturer's specifications making sure materials are properly anchored (See [Erosion Control Blankets](#)).

Construction Verification

Check materials and installation for compliance with specifications.



Figure 6.27 Crimping disc. Source: ABCs of BMPs, LLC.



Figure 6.28 Crimped straw. Source: ABCs of BMPs, LLC.

Table 6.10 Typical Mulching Materials and Application Rates

	Rate per Acre	Requirements	Installation Uses	Longevity
Organic Mulches				
Straw	3,000 - 4,500 lb./acre	Dry, unchopped, unweathered; free of weed seeds and rot	Spread by hand or machine, 1.5 to 2.5 inches deep; must be crimped or tacked with vegetative overspray	2 - 4 weeks
Paper, wood fiber, recycled newsprint	2,000 lb./acre	Can use paper on flatter areas, increase percentage of wood fiber as slopes steepen	To be used with hydroseeder, refer to seeding chart for dates to seed	2 - 4 months
Stabilized Fiber Matrix	Refer to manufacturers recommendations - usually 1,500 - 3,000 lb./acre	Typically requires wood fiber mulch to reduce rainfall impact. Requires 24-hour cure time-not used in concentrated flows	To be used on more erodible slopes, molecularly binds soil particles for improved erosion protection, can be used without seed for temporary soil protection	4 - 5 months
Bonded Fiber Matrix	Refer to manufacturers recommendations - 3,000 - 4,000 lb./acre depending on steepness of slope	24-hour cure time, can be used on slopes as steep as 2:1, not used in concentrated flows	Does not require smooth finish grade, can be used in soils with high rock content, can be used with out seed for temporary soil protection	4 - 6 months
Flexible Growth Medium	Refer to manufacturers recommendations - 3,000 - 4,500 lb./acre depending on steepness of slope	No cure time, can be used on slopes steeper than 1:1, not used in concentrated flows without TRM combination	Does not require smooth finish grade, can be used in soils with high rock content, molecularly binds soil particles, equivalent to short term erosion control blankets in many cases	up to 1 year
Wood Chips	10-20 Tons	Air dry, add nitrogen fertilizer	Apply with blower...	6 - 9 months
Bark	35 cubic yds.	Air dry...	Apply with...	6 - 9 months
Tackifiers				
Mulch tackifiers	Rates vary-refer to manufacturers specifications	Powders, liquids, crystals, etc.; most are water soluble	Mix with organic mulches to hold together, heavier rates required for steeper slopes	1 - 3 months
Straw Tackifiers	750 lb./acre	Recycled newsprint with tackifier	Spray ovetop of vegetative mulching to hold together for extended time.	1 - 3 months
Soil Binders				
Chemical and Biodegradable products: Many Trade Names	Follow manufacturers specifications	Use for temporary and longer term stabilization of non-vegetative soils	Some may be harmful to plant growth, check manufacturers recommendations for seeding limitations	30 days to 6 months depending upon rate

Source: ASP, Enterprises, 2009

* See Temporary Erosion Control Blanket section for nettings and mats.

**Enlist the assistance of a Certified Professional in Erosion and Sediment Control for specific recommendations.

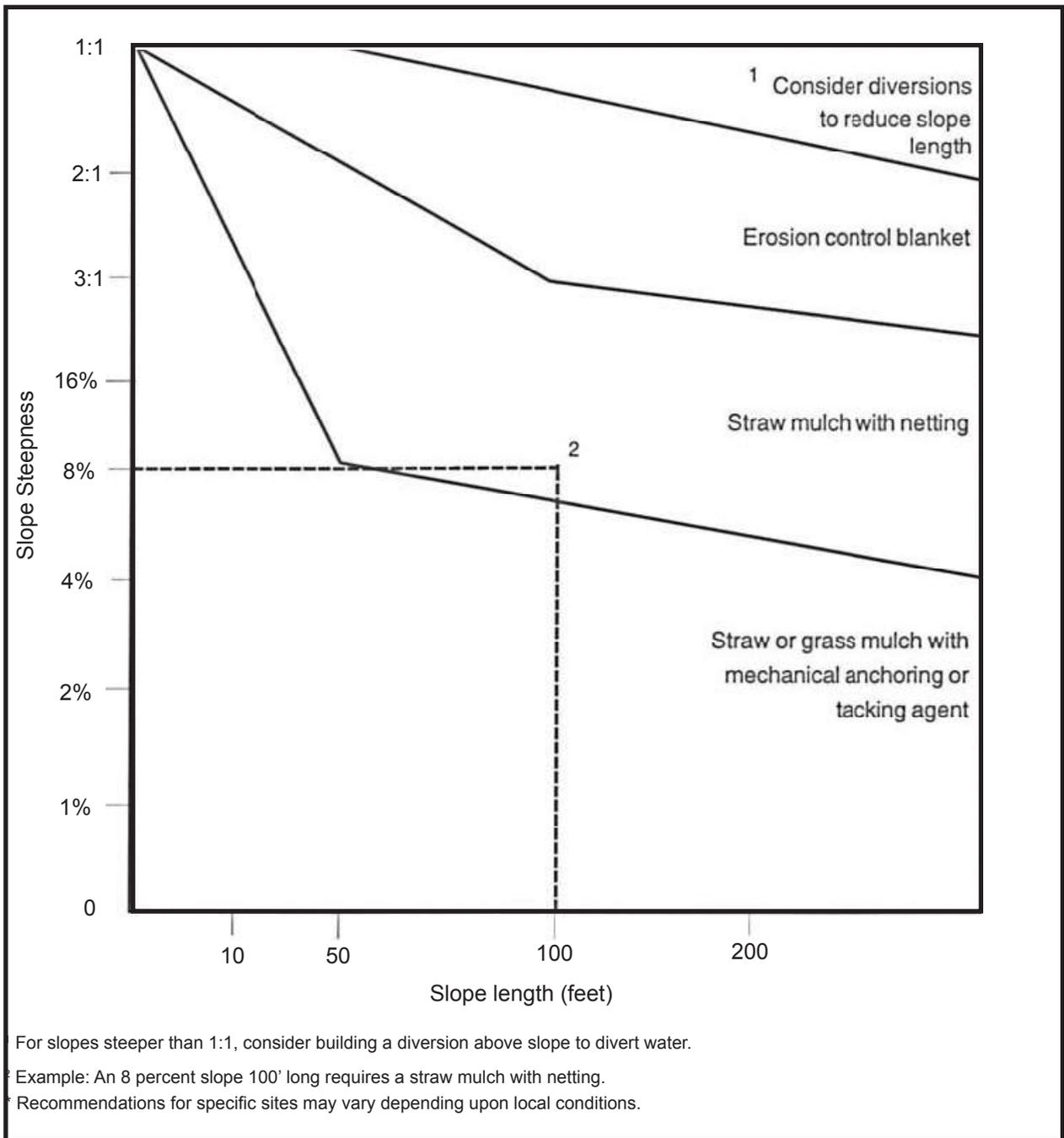


Figure 6.29 General mulch recommendations to protect from splash and sheet flow. Source: Adapted from *Minnesota Protecting Water Quality in Urban Areas, 1991*

Troubleshooting

Consult with a qualified design professional if any of the following occur:

- Variations in topography on-site indicate the mulching materials will not function as intended; changes in the plan may be needed.
- Design specifications for mulching materials or seeding requirements cannot be met; substitution may be required. Unapproved substitutions could result in erosion or seeding failure.

Maintenance and Inspection

Inspect all mulched areas on a weekly basis and after rainstorms for erosion and damage to the mulch. Repair promptly and restore to original condition. Continue inspections until vegetation is well established. Keep mower height high if plastic netting is used to prevent netting from wrapping around mower blades or shaft.

Common Problems and Solutions

Problem	Solution
Erosion, washout and poor plant establishment.	Check for proper topsoil, repair eroded surface, reseed, remulch and anchor mulch.
Mulch is lost to wind or stormwater runoff.	Reapply mulch and anchor by crimping, netting or tacking.
Mulch not anchored in channel; resulting in channel bottom eroding	Repair damage, replace mulch and anchor or install appropriate turf reinforcement mat channel liner.
Mulch deteriorates before plant establishment.	Check for proper topsoil, reapply mulch, do not hydromulch in winter.

Erosion Control Blankets



Figure 6.30 Follow manufacturer's recommendations to successfully install erosion control blankets or matting. The manufacturer of this high velocity blanket called for stapling every two feet and a check slot wherever two sections were joined. This blanket was used to protect soil and establish grass in a waterway on the August Busch Memorial Conservation Area

Practice Description

Erosion control blankets are used to aid in controlling erosion on critical areas by providing a protective cover made of straw, jute, wood or other plant fibers; plastic, nylon, paper or cotton. This practice is best used on slopes and channels where the erosion hazard is high and plant growth is likely to be slow to provide adequate protective cover for the seed and soil until germination. Erosion control blankets are typically used as an alternative to mulching but are also used to provide structural erosion protection.

Some important factors in the choice of a blanket are: soil conditions, steepness of slope, length of slope, type and duration of protection required to establish desired vegetation, and probable shear stress. (See [Compost](#) for compost blanket considerations.)

Recommended Minimum Requirements

Prior to the start of construction, the application of erosion control blankets should be designed by a qualified professional and plans and specifications should be available to field personnel. The field inspector should verify that installation is in accordance with the plans and specifications.

Numerous products designed to control erosion are available. Product installation procedures for manufactured erosion control blanket products should always be available from the manufacturer. Tables 6.11 and 6.12 list some of the more common temporary and permanent products available.

Table 6.11 Types of Temporary Erosion Control Blankets

ULTRA SHORT-TERM - Typical three month functional longevity						
Type	Product Description	Material Composition	Slope Applications*		Channel Applications*	Minimum
			Maximum Gradient	C Factor ^{2, 5}	Max. Shear Stress ^{3, 4, 6}	Tensile Strength ¹
1.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.1 @ 5:1	0.25 lb./ft. ² (12 Pa)	5 lb./ft. (0.073 kN/m)
1.B	Netless Rolled Erosion Control Blankets	Natural or polymer fibers mechanically interlocked or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.1 @ 4:1	0.5 lb./ft. ² (24 Pa)	5 lb./ft. (0.073 kN/m)
1.C	Single-net Erosion Control Blankets and Open Weave Textiles	Processed degradable natural or polymer fibers mechanically bound together by a single rapidly degrading, synthetic or natural fiber netting or an open weave textile of processed rapidly degrading natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	1.5 lb./ft. ² (72 Pa)	50 lb./ft. (0.73 kN/m)
1.D	Double-net Erosion Control Blankets	Processed degradable natural and/or polymer fibers mechanically bound together between two rapidly degrading, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.2 @ 2:1	1.75 lb./ft. ² (84 Pa)	75 lb./ft. (1.09 kN/m)
SHORT-TERM - Typical 12 month functional longevity						
2.A	Mulch Control Nets	A photodegradable synthetic mesh or woven biodegradable natural fiber netting.	5:1 (H:V)	< 0.1 @ 5:1	0.25 lb./ft. ² (12 Pa)	5 lb./ft. (0.073 kN/m)
2.B	Netless Rolled Erosion Control Blankets	Natural and/or polymer fibers mechanically interlocked or chemically adhered together to form a RECP.	4:1 (H:V)	< 0.1 @ 4:1	0.5 lb./ft. ² (24 Pa)	5 lb./ft. (0.073 kN/m)
2.C	Single-net Erosion Control Blankets and Open Weave Textiles	An erosion control blanket composed of processed degradable natural or polymer fibers mechanically bound together by a single degradable synthetic or natural fiber netting to form a continuous matrix or an open weave textile composed of processed degradable natural or polymer yarns or twines woven into a continuous matrix.	3:1 (H:V)	< 0.15 @ 3:1	1.5 lb./ft. ² (72 Pa)	50 lb./ft. (0.73 kN/m)
2.D	Double-net Erosion Control Blankets	Processed degradable natural and/or polymer fibers mechanically bound together between two degradable, synthetic or natural fiber nettings.	2:1 (H:V)	< 0.2 @ 2:1	1.75 lb./ft. ² (84 Pa)	75 lb./ft. (1.09 kN/m)

EXTENDED-TERM - Typical 24 month functional longevity.						
3.A	Mulch Control Nets	A slow degrading synthetic mesh or woven natural fiber netting.	5:1 (H:V)	< 0.10 @ 5:1	0.25 lb./ft. ² (12 Pa)	25 lb./ft. (0.36 kN/m)
3.B	Erosion Control Blankets & Open Weave Textiles	An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1.5:1 (H:V)	< 0.25 @ 1.5:1	2.00 lb./ft. ² (96 Pa)	100 lb./ft. (1.45 kN/m)
LONG-TERM - Typical 36 month functional longevity.						
4	Erosion Control Blankets and Open Weave Textiles	An erosion control blanket composed of processed slow degrading natural or polymer fibers mechanically bound together between two slow degrading synthetic or natural fiber nettings to form a continuous matrix or an open weave textile composed of processed slow degrading natural or polymer yarns or twines woven into a continuous matrix.	1:1 (H:V)	< 0.25 @ 1:1	2.25 lb./ft. ² (108 Pa)	125 lb./ft. (1.82 kN/m)

Source: *Erosion Control Technology Council.*

* "C" factor and shear stress for Types 1.A., 2.A. and 3.A mulch control nettings must be obtained with netting used in conjunction with pre-applied mulch material.

¹ Minimum Average Roll Values, Machine direction using ECTC Mod. ASTM D 5035.

² "C" Factor calculated as ratio of soil loss from RECP protected slope (tested at specified or greater gradient, h:v) to ratio of soil loss from unprotected (control) plot in large-scale testing.

³ Required minimum shear stress RECP (unvegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in) soil loss) during a 30-minute flow event in large-scale testing.

⁴ The permissible shear stress levels established for each performance category are based on historical experience with products characterized by Manning's roughness coefficients in the range of 0.01 - 0.05.

⁵ Acceptable large-scale test methods may include ASTM D6459, or other independent testing deemed acceptable by the engineer.

⁶ Per the engineers discretion. Recommended acceptable large-scale testing protocol may include ASTM D6460, or other independent testing deemed acceptable by the engineer.

TABLE 6.12 Types of Temporary Erosion Control Blankets - For applications where vegetation alone will not sustain expected flow conditions or provide sufficient long-term erosion protection.

PERMANENT¹ - All categories of TRMs must have a minimum thickness of 0.25 inches (6.35 mm) per ASTM D 6525 and U.V. stability of 80 percent per ASTM D 4355 (500 hours exposure).					
Type	Product Description	Material Composition	Slope Applications	Channel Applications*	Minimum
			Maximum Gradient	Max. Shear Stress ^{4, 6}	Tensile Strength ^{2, 3}
5.A	Turf Reinforcement Mat	Turf Reinforcement Mat – A rolled erosion control product composed of non-degradable synthetic fibers, filaments, nets, wire mesh or other elements, processed into a permanent, three-dimensional matrix of sufficient thickness. Mats that may be supplemented with degradable components, are designed to impart immediate erosion protection, enhance vegetation establishment and provide long-term functionality by permanently reinforcing vegetation during and after maturation. Note: Mats are typically used in hydraulic applications, such as high flow ditches and channels, steep slopes, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation or in areas where limited vegetation establishment is anticipated.	0.5:1 (H:V)	6.0 lbs/ft ² (288 Pa)	125 lbs/ft (1.82 kN/m)
5.B	Turf Reinforcement Mat		0.5:1 (H:V)	8.0 lbs/ft ² (384 Pa)	150 lbs/ft (2.19 kN/m)
5.C	Turf Reinforcement Mat		0.5:1 (H:V)	10.0 lbs/ft ² (480 Pa)	175 lbs/ft (2.55 kN/m)

Source: *Erosion Control Technology Council*.

- ¹ For mats containing degradable components, all property values must be obtained on the non-degradable portion of the matting alone.
- ² Minimum Average Roll Values, machine direction only for tensile strength determination using ASTM D6818 (Supercedes Mod. ASTM D5035 for RECPs)
- ³ Field conditions with high loading or high survivability requirements may warrant the use of a mat with a tensile strength of 44 kN/m (3,000 lb./ft.) or greater.
- ⁴ Required minimum shear stress mat (fully vegetated) can sustain without physical damage or excess erosion (> 12.7 mm (0.5 in.) soil loss) during a 30-minute flow event in large scale testing.
- ⁵ Acceptable large-scale testing protocol may include ASTM D6460, or other independent testing deemed acceptable by the engineer.

Construction Site Preparation

- Grade the site in accordance with the approved design to a smooth and uniform surface, free of debris.
- Add and incorporate topsoil where needed.
- Make sure seed bed is firm yet friable.
- Seed and fertilize as shown on the design plan.

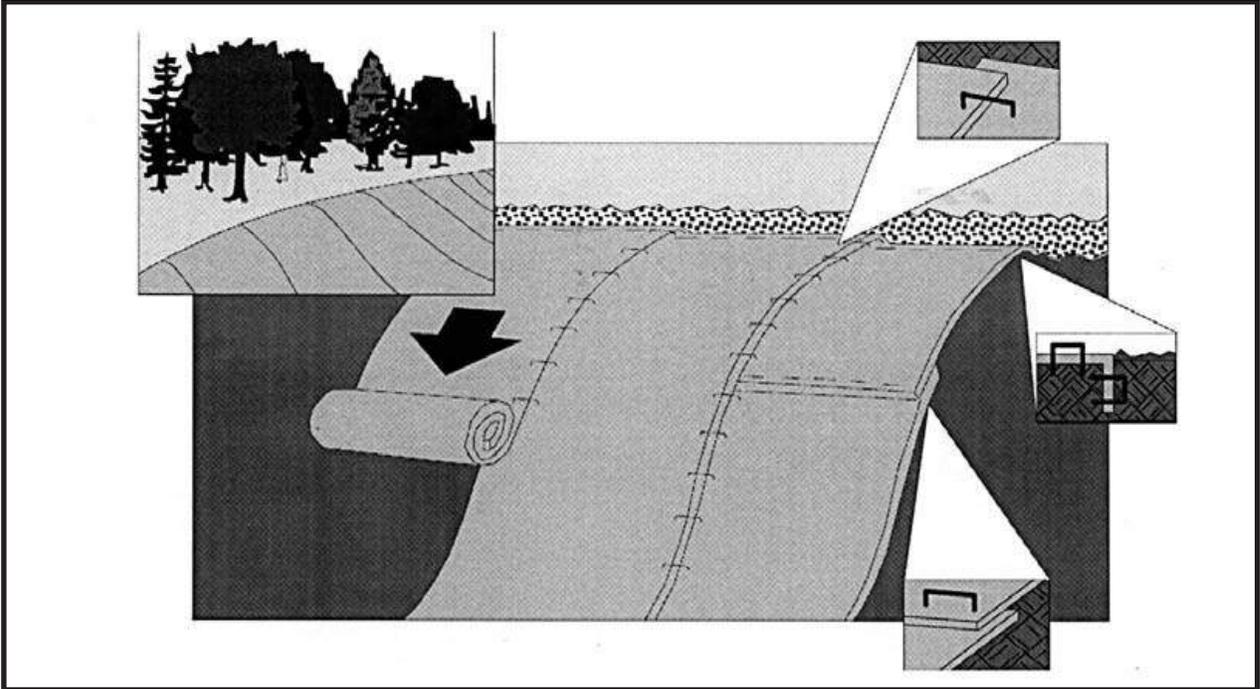


Figure 6.31 Typical installation of erosion control blankets on a slope - Consult manufacturer for recommendations on proper installation of staple patterns, overlap and keying edges.

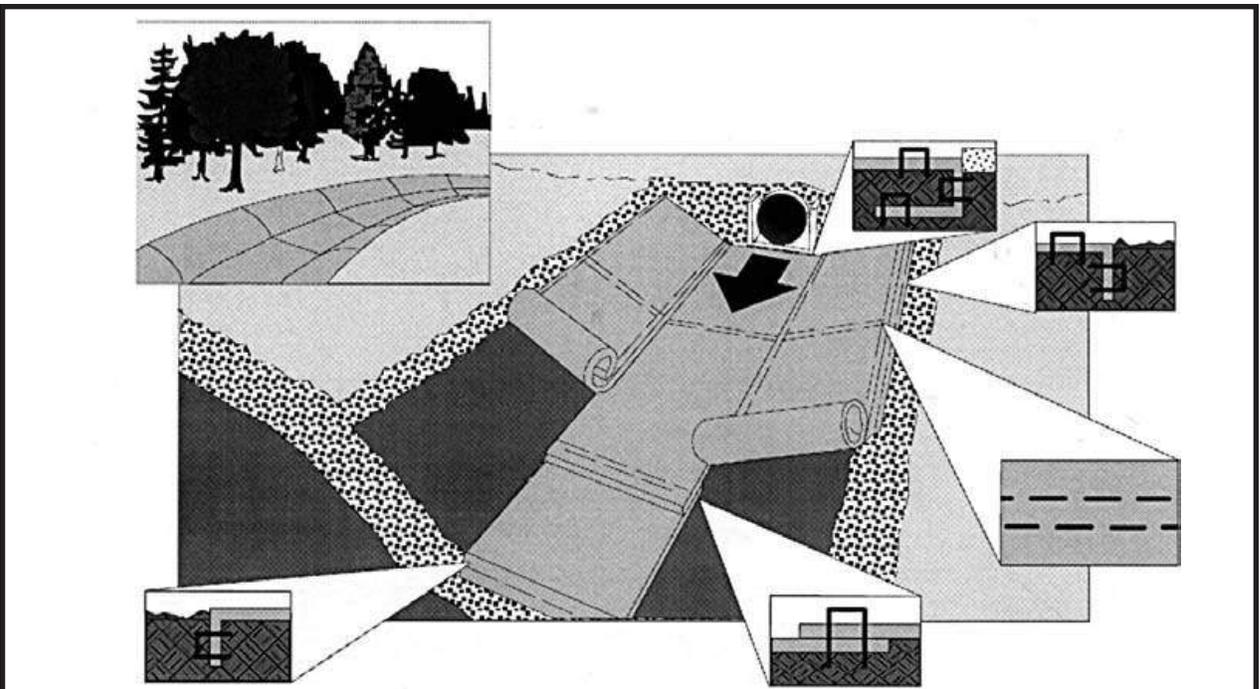


Figure 6.32 Typical installation of erosion control blankets in a channel - Consult manufacturer for recommendations on proper installation of staple patterns, overlap and keying edges.

Erosion Control Blankets

Blanket Installation

Install erosion control products in accordance with the manufacturer's recommendations and specifications, including check slots and stapling materials.

Anchor product so a continuous, firm contact (no tenting) with the soil surface/seed bed is maintained. Soil must be fine graded with no clods.

Note: Failure to do the above could result in soil erosion, which would require regrading and reseeding.

Construction Verification

Check finished grade, dimensions and staple spacing of erosion control blankets. Check materials for compliance with specifications.

- Movement of the blanket or erosion under the blanket is observed.
- Variations in topography on-site indicate erosion control mat will not function as intended; changes in the plan may be needed, or a blanket with a shorter or longer life may be needed.
- Design specifications for seed variety, seeding dates or erosion control materials cannot be met; substitution may be required. Unapproved substitutions could result in failure to establish vegetation.

Maintenance, Inspection and Removal

Inspect weekly and after storm events, until vegetation is established, for erosion or undermining beneath the blankets. If any area shows erosion, pull back that portion of the blanket, add tamped soil and reseed; then resecure the blankets.

If blankets become dislocated or damaged, repair or replace and resecure immediately.

Although some erosion control blankets are temporary, they are left in place to decompose and are not to be removed prior to filing [Form H: Request for Termination of a General Permit](#), Form--MO 780-1409 (see [Chapter One - Missouri Permit Requirements](#)).

Common Problems and Solutions

Problem	Solution
Surface water flows under rather than over the blanket, causing erosion. This may be caused by poor contact between soil and the erosion control blanket.	Smooth grade or remove large clods and retrench or reanchor to direct water over blanket.
Tenting (air pockets under blanket), blanket movement or displacement is caused by blanket inadequately or improperly stapled.	Reinstall and ensure blanket is properly anchored.
Blanket or slope failure caused by unstable slope.	Determine cause of slope failure, stabilize slope and reinstall blanket.

Dust Control



Figure 6.33 Spraying water is effective for dust control on haul roads, although it must be frequently repeated during hot days or heavy traffic periods. Source: C. Rahm, NRCS. St. Charles Co.

Dust Control

In Missouri, the contractor is required by State law to control fugitive dust blown from the site. Kansas does not have specific regulations for fugitive dust emissions; however, the Kansas Department of Health and Environment encourages contractors to implement measures to reduce such emissions. Dust can be minimized by stabilizing areas with mulch as soon as possible. Provide watering in unstabilized areas. Contact Missouri Department of Natural Resources or Kansas Department of Health and Environment for guidance.

Practice Description

Dust control includes a wide range of techniques that reduce movement of wind-borne soil particles (dust) from disturbed soil surfaces. This practice applies to construction routes and other disturbed areas where on-site and off-site damage or hazards may occur if dust is not controlled.

Recommended Minimum Requirements

Dust control measures should be designed by a qualified professional. The site superintendant and field personnel should refer to plans and specifications throughout the construction process. Whenever possible, leave undisturbed vegetated buffer areas between graded areas.

Scheduling

Plan and schedule construction operations so the smallest area is disturbed at one time.

Erosion Control

Install surface stabilization measures immediately after completing land grading.

Construction

Any combination of the following may be used to help reduce dust and air pollution at a construction site.

Vegetative Cover

For areas not subjected to traffic, vegetation provides the most practical method of dust control (See [Temporary or Permanent Seeding](#)).

Sprinkling

The site can be sprinkled with water until the surface is moist. This practice is effective for dust control on haul roads or other traffic routes, but constant repetition is required for effective control.

Soil Stabilizers and Binders

Soil stabilizers are polymers that bind the soil particles together so they are less likely to be transported in the air from the energy of the wind.

Limitations

- Soil binders are temporary in nature and may need reapplication.
- Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer, which may be 24 hours or longer. Soil binders may need reapplication after a storm event.
- Soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely the runoff will undercut the stabilized soil layer and discharge at a point further down slope.
- Some soil binders do not hold up to pedestrian or vehicular traffic across treated areas. Consult manufacturers' representatives for specific applications and limitations of materials.
- Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted. Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil.
- Soil binders may not cure if low temperatures occur within 24 hours of application.

General Considerations

- Site-specific soil types will dictate appropriate soil binders to be used.
- A soil binder must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical and shall not stain paved or painted surfaces.
- Some soil binders are compatible with existing vegetation.
- Performance of soil binders depends on temperature, humidity and traffic across treated areas.
- Avoid over-spray onto the traveled way, sidewalks, lined drainage channels, and existing vegetation.

Dust Control

Water clarifying compounds may be used on mineral soils for dust control. Traffic must be kept off treated areas to prevent the product from becoming ineffective. The manufacturer or supplier shall provide written application methods for the water clarifying compounds and mixtures. The application method shall ensure uniform coverage to the target and avoid drift to non-target areas including waters of the state. The manufacturer or supplier shall also provide written instructions to ensure proper safety, storage and mixing of the product.

Mulching

This practice offers a fast and effective means of controlling dust when properly applied. Use binders or tackifiers to tack organic mulches (See [Mulch and Hydromulch](#)). Mulching is not recommended for areas with heavy traffic.

Barriers

Board fences placed perpendicular to the prevailing winds at intervals of 15 times the barrier height can control blowing soil. In areas of known dust problems, windbreak vegetation should be preserved.

If the following materials or any other chemicals are used for dust control, contact the Missouri Department of Natural Resources, Water Pollution Control Program, or the Kansas Department of Health and Environment for permit requirements.

- Calcium Chloride - This material is best used on road surfaces. It can be applied by a mechanical spreader at a rate that keeps the surface moist.

Note: This method may cause restrictions for vegetation establishment.

Maintenance and Inspection

- Maintain dust control measures continuously throughout dry weather periods until all disturbed areas have been stabilized.
- If using a soil binder, it may need to be reapplied for proper maintenance.
- High traffic areas shall be inspected daily, and lower traffic areas shall be inspected weekly.
- After any rainfall event, the permittee is responsible for maintaining all slopes to prevent erosion.

Troubleshooting

Consult with a qualified professional if the following occurs:

- Spray-on adhesives are specified. A permit may be needed.

Common Problems and Solutions

Problem	Solution
Dry soils and increase in dust problems caused by drought conditions.	Use greater precautions during these periods.

SECTION 8

Local Regulations & Additional Permits

Local Ordinances can be located here for reference only. Additional permits (i.e. 404, NWP, grading permits if required, etc.) can be kept here for reference only.

SECTION 9

Spill Response

This section contains Missouri Code of State Regulations as they pertain to hazardous substances and emergency response. Contained within are:

Division 24 - Hazardous Substance Emergency Response Office

-10 CSR 24-1.010 - Organization

-10 CSR 24-2.010 - Definitions

-10 CSR 24-3.010 - Emergency Notification Procedures

Spill Report Forms



Rules of
Department of Natural Resources
Division 24—Hazardous Substance
Emergency Response Office
Chapter 1—Organization

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**Title 10—DEPARTMENT OF
NATURAL RESOURCES
Division 24—Hazardous Substance
Emergency Response Office
Chapter 1—Organization**

10 CSR 24-1.010 General Organization

PURPOSE: This rule explains the organization and responsibilities of the Hazardous Substance Emergency Response Office. Also explained is how to obtain additional information regarding these activities and where to make submittals to this office.

(1) The Department of Natural Resources is authorized under sections 260.500–260.550, RSMo to administer the state’s Hazardous Substance Emergency Response Office. The director of the Department of Natural Resources appoints a director and staff who provide day-to-day operation of the Hazardous Substance Emergency Response Office.

(A) Among its operations, the Hazardous Substance Emergency Response Office performs the following administrative and technical functions: develop and adopt rules relating to hazardous substance emergencies; develop and update the state Hazardous Substance Emergency Response plan in cooperation with other state agencies and other affected persons; respond to, investigate, document and take action regarding hazardous substance emergencies in accordance with sections 260.500–260.550, RSMo; provide technical assistance to other state agencies, to political subdivisions of the state and to other persons upon request for the prevention, control and response to hazardous substance emergencies; enter into agreements with state, local and federal agencies and with other persons as necessary to develop and implement the Hazardous Substance Emergency Response Plan and to implement sections 260.500–260.550, RSMo; monitor the statewide telephone used to notify Missouri whenever a hazardous substance emergency occurs; notify appropriate agencies of hazardous substance emergencies; and cooperate with appropriate units of government and other persons to prevent the occurrence and improve response to hazardous substance emergencies.

(B) Requests for copies of rules, reports of incident investigations, technical information and assistance and any other submissions are to be made to the department’s Hazardous Substance Emergency Response Office, Environmental Services Program, P.O. Box 176, Jefferson City, MO 65102. The telephone number during office hours is (573) 526-

3348. For emergencies, the Hazardous Substance Emergency Response Office can be contacted any time at (573) 634-2436.

(2) Information.

(A) The mailing address for the Hazardous Substance Emergency Response Office is: Missouri Department of Natural Resources, P.O. Box 176, Jefferson City, MO 65102.

(B) The Hazardous Substance Emergency Response Office files, except trade secrets as provided for in section 260.550, RSMo, are public information and are located at 2710 West Main Street, Jefferson City, MO 65109.

(C) Anyone wishing to review information in the Hazardous Substance Emergency Response Office files is requested to make an appointment by calling (573) 526-3348. There is no fee for reviewing file information. There is a copying fee if copies of file information are made, and it must be paid by check, money order or exact change.

(D) Any request for information shall be in writing. All requests for information shall be available during normal business hours for inspection by the public.

(E) Nonemergency information can be obtained by contacting the department at the post office box listed previously or by calling (573) 526-3348.

(F) The number to contact the department for emergency release notifications under section 260.505, RSMo is (573) 634-2436. This is for emergencies only.

AUTHORITY: section 260.520, RSMo (Supp. 1995). Original rule filed Nov. 30, 1983, effective April 12, 1984. Emergency amendment filed Dec. 2, 1992, effective Jan. 1, 1993, expired April 20, 1993. Amended: Filed Oct. 5, 1992, effective April 8, 1993. Amended: Filed June 14, 1994, effective Jan. 29, 1995. Amended: Filed July 22, 1996, effective Feb. 28, 1997.*

**Original authority 1983, amended 1993, 1995.*

Rules of
Department of Natural Resources
Division 24—Hazardous Substance
Emergency Response Office
Chapter 2—Definitions

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**Title 10—DEPARTMENT OF
NATURAL RESOURCES
Division 24—Hazardous Substance
Emergency Response Office
Chapter 2—Definitions**

10 CSR 24-2.010 Definitions

PURPOSE: This rule provides definitions for terms used in 10 CSR 24.

PUBLISHER'S NOTE: The secretary of state has determined that the publication of the entire text of the material which is incorporated by reference as a portion of this rule would be unduly cumbersome or expensive. Therefore, the material which is so incorporated is on file with the agency who filed this rule, and with the Office of the Secretary of State. Any interested person may view this material at either agency's headquarters or the same will be made available at the Office of the Secretary of State at a cost not to exceed actual cost of copy reproduction. The entire text of the rule is printed here. This note refers only to the incorporated by reference material.

- (1) Administrator—the administrator of the United States Environmental Protection Agency.
- (2) Cleanup—all actions necessary to contain, collect, control, identify, analyze, cleanup, treat, disperse, remove or dispose of a hazardous substance.
- (3) Cleanup costs—all costs incurred by the state or any of its political subdivisions or their agents or by any other person participating with the approval of the Department of Natural Resources in the prevention or mitigation of damages from a hazardous substance emergency or the cleanup of a hazardous substance involved in a hazardous substance emergency.
- (4) Department—the Department of Natural Resources.
- (5) Director—director of the Department of Natural Resources.
- (6) Extremely hazardous substance—a substance listed under 40 CFR part 355 by the administrator.
- (7) Hazardous substance—any substance or mixture of substances that presents a danger to the public health or safety or the environment and includes:
- (A) Any hazardous waste identified or listed by the department under sections 260.350–260.430, RSMo;
- (B) Any element, compound, mixture, solution or substance designated pursuant to Sections 101(14) and 102 of the Comprehensive Environment Response, Compensation and Liability Act (CERCLA) of 1980 or designated pursuant to section 304 of the Federal Emergency Planning and Community Right-to-Know Act of 1986; and
- (C) Any hazardous material designated by the secretary of the United States Department of Transportation under the Hazardous Materials Transportation Act.
- (8) Hazardous substance emergency and emergency involving a hazardous substance—
- (A) Any release of hazardous substances or extremely hazardous substances in quantities equal to or in excess of those determined pursuant to section 101(14) or 102 of the CERCLA of 1980 or section 304 of the Federal Emergency Planning and Community Right-to-Know Act of 1986;;
- (B) Any release of petroleum including crude oil or any fraction, natural gas, natural gas liquids, liquefied natural gas or synthetic gas usable for fuel (or mixture of natural gas and synthetic gas) in excess of fifty (50) gallons for liquids or three hundred (300) cubic feet for gases;
- (C) Any release of a hazardous waste which is reportable under sections 260.350–260.430, RSMo;
- (D) Any release of a hazardous substance which requires immediate notice under 49 CFR part 171; and
- (E) The department shall promulgate rules identifying the substances and the quantities of substances which, if released, constitute a hazardous substance emergency.
- (9) Hazardous Substance Emergency Response Plan—the plan, as specified in section 260.505, RSMo, developed and maintained by the Missouri Department of Natural Resources for response to hazardous substance emergencies.
- (10) Local Emergency Planning Committee (LEPC) or committee—the people appointed by the Missouri Emergency Response Commission (MERC) for the purpose of improving hazardous chemical safety and preparedness.
- (11) Local government—any county, township, municipal corporation, school district or other governmental body of equivalent rank.
- (12) Person—any individual, partnership, copartnership, firm, company, public or private corporation, association, joint stock company, trust, estate, political subdivision or any agency, board, department or bureau of the state or federal government or any other legal entity which is recognized by law as the subject of rights and duties.
- (13) Person having control over a hazardous substance—any person producing, handling, storing, transporting, refining or disposing of a hazardous substance when a hazardous substance emergency occurs, including bailees, carriers and any other person in control of a hazardous substance when a hazardous substance emergency occurs, whether they own the hazardous substance or are operating under a lease, contract or other agreement with the legal owner.
- (14) Release—any threatened or real emission, discharge, spillage, leakage, pumping, pouring, emptying or dumping of a substance into or onto the land, air or waters of the state unless done in compliance with the conditions of a federal or state permit, unless the substance is confined and is expected to stay confined to property owned, leased or otherwise controlled by the person having control over the substance or unless, in the case of pesticides, application is done in accordance with the product label.
- (15) State of Missouri Basic Emergency Operations Plan—the state plan, its annexes and appendices as developed or maintained by the state emergency management agency for response to natural and man-made disasters in this state.
- (16) Waters of the state—all rivers, streams, lakes and other bodies of surface and subsurface water lying within or forming a part of the boundaries of the state which are not entirely confined and located completely upon lands owned, leased or otherwise controlled by a single person or by two (2) or more persons jointly or as tenants in common and include waters of the United States lying within the state.

AUTHORITY: section 260.520, RSMo Supp. 1993. Original rule filed Nov. 30, 1983, effective April 12, 1984. Emergency amendment filed Dec. 2, 1992, effective Jan. 1, 1993, expired April 30, 1993. Amended: Filed Oct. 5, 1992, effective April 8, 1993.*



Amended: Filed June 14, 1994, effective Jan. 29, 1995.

**Original authority: 260.520, RSMo 1983, amended 1993.*

Rules of
Department of Natural Resources
Division 24—Hazardous Substance Emergency
Response Office
Chapter 3—Emergency Notification Procedures

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10 CSR 24-3.010 Notification Procedures for Hazardous Substance Emergencies and for Emergency Notification of Releases of Hazardous Substances and Extremely Hazardous Substances	3



**Title 10—DEPARTMENT OF
NATURAL RESOURCES
Division 24—Hazardous Substance
Emergency Response Office
Chapter 3—Emergency Notification
Procedures**

**10 CSR 24-3.010 Notification Procedures
for Hazardous Substance Emergencies and
for Emergency Notification of Releases of
Hazardous Substances and Extremely Haz-
ardous Substances**

PURPOSE: This rule establishes a statewide emergency telephone number to notify Missouri whenever a hazardous substance emergency occurs and specifies the requirements for emergency notification and follow-up written notices in the event of a hazardous substance emergency, the release of a reportable quantity of a hazardous substance and the release of a reportable quantity of an extremely hazardous substance.

PUBLISHER'S NOTE: The publication of the full text of the material that the adopting agency has incorporated by reference in this rule would be unduly cumbersome or expensive. Therefore, the full text of that material will be made available to any interested person at both the Office of the Secretary of State and the office of the adopting agency, pursuant to section 536.031.4, RSMo. Such material will be provided at the cost established by state law.

(1) Any person having control over a hazardous substance shall contact Missouri by telephone at (573) 634-2436 or the National Response Center at (800) 424-8802 at the earliest practical moment upon discovery of an emergency involving a hazardous substance under his/her control. Information to be provided to Missouri to the best ability of the person having control over the hazardous substance includes: substance(s) involved, an indication of whether the substance is an extremely hazardous substance; the medium or media into which the release occurred; any known or anticipated acute or chronic health risks associated with the release and, where appropriate, advice regarding medical attention necessary for exposed individuals; proper precautions to take as a result of the release, including evacuation; amount of the substance(s) released or in danger of being released; location of the hazardous substance emergency and directions to the site; names, addresses and phone numbers of persons that may have information on the substances involved; when the hazardous substance emergency occurred, duration of the release

and when it was discovered; actions taken to cleanup the hazardous substance and to end the hazardous substance emergency and when those actions will be taken; and any other pertinent information requested by Missouri, or as specified in the Missouri hazardous waste management commission regulations at 10 CSR 25-7.264(2)(D) and (E) and 10 CSR 25-7.265(2)(D) and (E). Federal reporting requirements for releases of hazardous substances can be found in 40 CFR parts 302 and 355. In addition, state reporting requirements contained in 11 CSR 40-4.030 reference these regulations, and require that certain information be provided to Local Emergency Planning Committees (LEPCs) for reportable releases of hazardous substances and extremely hazardous substances.

(2) The person monitoring the statewide emergency telephone shall notify appropriate agencies of the hazardous substance emergency as designated in the Hazardous Substance Emergency Response Plan.

(3) Upon request, written follow-up notifications are required for releases of hazardous substances and extremely hazardous substances as listed in 40 CFR parts 302 and 355. If requested, the person having control of the hazardous substance or extremely hazardous substance shall provide a written follow-up emergency notice (or notices, as more information becomes available) to the department setting forth and updating the information with respect to—

- (A) Information required in section (1);
- (B) Actions taken to respond to and contain the release;
- (C) Any known or anticipated acute or chronic health risks associated with the release; and
- (D) Where appropriate, advice regarding medical attention necessary for exposed individuals.

(4) If requested, a written report shall be provided to the department for any other hazardous substance emergency. The requested reports shall contain the information as specified in sections (1) and (3) of this rule and any other pertinent information as requested by the department. In addition, state reporting requirements in 11 CSR 40-4.030 require that written follow-up reports be provided to the Department of Public Safety and appropriate LEPCs for any reportable releases of hazardous substances or extremely hazardous substances.

*AUTHORITY: section 260.520, RSMo (Supp. 1995). * Original rule filed Nov. 30, 1983, effective April 12, 1984. Emergency amend-*

ment filed Dec. 2, 1992, effective Jan. 1, 1993, expired April 30, 1993. Amended: Filed Oct. 5, 1992, effective April 8, 1993. Amended: Filed June 14, 1994, effective Jan. 29, 1995. Amended: Filed July 22, 1996, effective Feb. 28, 1997.

**Original authority 1983, amended 1993, 1995.*

Spill Report Form

For spills of reportable quantities that impact soil, surface water or ground water call MDNR 24-hour Environmental Emergency Response at 573-634-2436.

Site: _____ Primary Contractor: _____

Date: _____ Incident Date: _____

Complete for any type of petroleum product or hazardous materials / waste spill or incident. If the spill is of reportable quantity, report must be submitted within five (5) business days.

Keep a copy of this report with the SWPPP Log.

Person Reporting Spill or Incident	
Name	Address
Organization	
Title	
Telephone	
Email	Signature

Type of Spill:
Common Name of Spilled Substance
Estimated Quantity Spilled
Estimated Concentration
Date and Duration of Spill
Date Clean Up Completed

SPILL TO LAND	SPILL TO WATER BODY
Name of site:	Name of water body:
Street address:	Location of discharge
City	Description of area from which spilled material may reach:
County:	

Actions Taken:

To contain spill:

To clean up spill:

To remove/dispose of spilled substance and cleanup material:

To prevent reoccurrence:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Person responsible for managing spill response:	
Name	Signature
Phone	Email

Spill Report Form

For spills of reportable quantities that impact soil, surface water or ground water call MDNR 24-hour Environmental Emergency Response at 573-634-2436.

Site: _____ Primary Contractor: _____

Date: _____ Incident Date: _____

Complete for any type of petroleum product or hazardous materials / waste spill or incident. If the spill is of reportable quantity, report must be submitted within five (5) business days.

Keep a copy of this report with the SWPPP Log.

Person Reporting Spill or Incident	
Name	Address
Organization	
Title	
Telephone	
Email	Signature

Type of Spill:
Common Name of Spilled Substance
Estimated Quantity Spilled
Estimated Concentration
Date and Duration of Spill
Date Clean Up Completed

SPILL TO LAND	SPILL TO WATER BODY
Name of site:	Name of water body:
Street address:	Location of discharge
City	Description of area from which spilled material may reach:
County:	

Actions Taken:

To contain spill:

To clean up spill:

To remove/dispose of spilled substance and cleanup material:

To prevent reoccurrence:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Person responsible for managing spill response:	
Name	Signature
Phone	Email

SECTION 10

Endangered Species Documentation



March 27, 2023

Missouri Department of Conservation
Resource Science Division
Missouri Natural Heritage Review Web Site
P.O. Box 180
Jefferson City, MO 65102-0180

We are proposing to construct the Cassville High School Performing Arts Center in Cassville, Missouri. The site is located at Section-Township-Range: 21-23N-27W in Barry County, Missouri.

Researching on-line at the Missouri Natural Heritage Review web site for endangered species or critical habitat on or near the project site, we received a Level 2 report.

Enclosed please find a copy of the Level 2 report and a copy of the Cassville quadrangle map – Barry County, MO of the proposed area.

Please advise if our project is close enough to impact any resources in question.

If you have any questions or need additional information, please feel free to contact us.

Sincerely,

Sean McKiernan
Olsson
(smckiernan@olsson.com)



Missouri Department of Conservation

Missouri Department of Conservation's Mission is to protect and manage the forest, fish, and wildlife resources of the state and to facilitate and provide opportunities for all citizens to use, enjoy and learn about these resources.

Natural Heritage Review Level Two Report: State Listed Endangered Species and/or Missouri Species/Natural Communities of Conservation Concern

There are records of state-listed Endangered Species, or Missouri Species or Natural Communities of Conservation Concern within or near the defined Project Area. Please contact Missouri Department of Conservation for further coordination.

Foreword: Thank you for accessing the Missouri Natural Heritage Review Website developed by the Missouri Department of Conservation with assistance from the U.S. Fish and Wildlife Service, the U.S. Army Corps of Engineers, Missouri Department of Transportation and NatureServe. The purpose of this report is to provide information to federal, state and local agencies, organizations, municipalities, corporations, and consultants regarding sensitive fish, wildlife, plants, natural communities, and habitats to assist in planning, designing, and permitting stages of projects.

PROJECT INFORMATION

Project Name and ID Number: Cassville Performing Arts Center #12457

Project Description: S21-T23N-R27W, 36.68978/ -93.86238, Unnamed tributary to Flat Creek, Barry County

Project Type: Residential, Commercial and Governmental Building Development

Contact Person: Civil Olsson

Contact Information: SGFGCV@olsson.com or 4178908802

Disclaimer: This NATURAL HERITAGE REVIEW REPORT identifies if a species or natural community tracked by the Natural Heritage Program is known to occur within or near the project area submitted, and shares recommendations to avoid or minimize project impacts to sensitive species or natural habitats. Incorporating information from the Natural Heritage Program into project plans is an important step in reducing impacts to Missouri's sensitive natural resources. If an occurrence record is present, or the proposed project might affect federally listed species, the user must contact the Department of Conservation or U.S. Fish and Wildlife Service for more information.

This Natural Heritage Review Report is not a site clearance letter for the project. Rather, it identifies public lands and records of sensitive resources located close to and/or potentially affected by the proposed project. If project plans or location change, this report may no longer be valid. Because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present. Therefore, reports include information about records near but not necessarily on the project site. Lack of an occurrence record does not mean that a sensitive species or natural community is not present on or near the project area. On-site verification is the responsibility of the project. However, the Natural Heritage Program is only one reference that should be used to evaluate potential adverse project impacts and additional information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Reviewing current landscape and habitat information, and species' biological characteristics would additionally ensure that Missouri Species of Conservation Concern are appropriately identified and addressed in planning efforts.

U.S. Fish and Wildlife Service – Endangered Species Act (ESA) Coordination: Lack of a Natural Heritage Program occurrence record for federally listed species in your project area does not mean the species is not present, as the area may never have been surveyed. Presence of a Natural Heritage Program occurrence record does not mean the project will result in negative impacts. This report does not fulfill Endangered Species Act consultation with the U.S. Fish and Wildlife Service (USFWS) for listed species. Direct contact with the USFWS may be necessary to complete consultation and it is required for actions with a federal connection, such as federal funding or a federal permit; direct contact is also required if ESA concurrence is necessary. Visit [IPaC: Home \(fws.gov\)](https://www.fws.gov/ipac) to initiate USFWS Information for Planning and Conservation (IPaC) consultation. Contact the Columbia Missouri Ecological Field Services Office (573-234-2132, or by mail at 101 Park Deville Drive, Suite A, Columbia, MO 65203) for more information.

Transportation Projects: If the project involves the use of Federal Highway Administration transportation funds, these recommendations may not fulfill all contract requirements. Please contact the Missouri Department of Transportation at 573-526-4778 or visit [Home Page | Missouri Department of Transportation \(modot.org\)](https://www.modot.org) for additional information on recommendations.

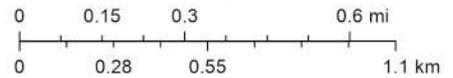
Cassville Performing Arts Center



March 27, 2023

1:19,977

-  Buffered Project Boundary
-  Project Boundary



Esri, NASA, NGA, USGS, FEMA, Missouri Dept. of Conservation, Missouri DNR, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

Species or Communities of Conservation Concern within the Area:

There are records of state-listed Endangered Species, or Missouri Species or Natural Communities of Conservation Concern within or near the defined Project Area. Please contact the Missouri Department of Conservation for further coordination.

Email (preferred): NaturalHeritageReview@mdc.mo.gov

MDC Natural Heritage Review

Science Branch

P.O. Box 180

Jefferson City, MO

65102-0180

Phone: 573-522-4115 ext. 3182

Other Special Search Results:

The project occurs on or near public land, Cassville City Greenway, please contact MDC.

Project Type Recommendations:

New construction, maintenance and remodeling, including government, commercial and residential buildings and other structures. Fish, forest, and wildlife impacts can be avoided by siting projects in locations that have already been disturbed or previously developed, where and when feasible, and by avoiding alteration of areas providing existing habitat, such as wetlands, streams, forest, native grassland, etc. The project should be managed to minimize erosion and sedimentation/runoff to nearby wetlands, streams and lakes, including adherence to any Clean Water Act permit conditions. Project design should include stormwater management elements that assure storm discharge rates to streams for heavy rain events will not increase from present levels. Revegetate areas in which the natural cover is disturbed to minimize erosion using native plant species compatible with the local landscape and wildlife needs. Annual ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as crownvetch and sericea lespedeza. Pollutants, including sediment, can have significant impacts far downstream. Use silt fences and/or vegetative filter strips to buffer streams and drainages, and monitor the site after rain events and until a well-rooted ground cover is reestablished. Please see [Best Management Practices for Construction and Development Projects Affecting Missouri Rivers and Streams \(mo.gov\)](#).

Project Location and/or Species Recommendations:

Endangered Species Act Coordination - If this project has the potential to alter habitat (e.g. tree removal, projects in karst habitat) or cause direct mortality of bats, please coordinate directly with U.S. Fish and Wildlife Service (Ecological Services, 101 Park Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 Ext. 100 for Ecological Services) for further coordination under the Endangered Species Act. Indiana bats (*Myotis sodalis*, federal- and state-listed endangered) and Northern long-eared bats (*Myotis septentrionalis*, federal-listed threatened) may occur near the project area. Both of these species of bats hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in wooded areas, often riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana bats or Northern long-eared bats, especially from September to April.

Gray Bat: The submitted project location is within the range of the Gray Myotis (i.e., Gray Bat) in Missouri. Depending on habitat conditions of your project's location, Gray Myotis (*Myotis grisescens*, federal and state-listed endangered) could occur within the project area, as they forage over streams, rivers, lakes, and reservoirs. Avoid entry or disturbance of any cave inhabited by Gray Myotis and when possible retain forest vegetation along the stream and from the cave opening to the stream. Please see [Best Management Practices for Construction and Development Projects Gray bat \(mo.gov\)](#).

Karst: This county has known karst geologic features (e.g., caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are Species of Conservation Concern) are influenced by changes to water quality; please check your project site for any karst features and make every effort to protect groundwater in the project area. Additional information and specific recommendations are available at [Management Recommendations for Construction and Development Projects Affecting Missouri Karst Habitat \(mo.gov\)](#).

Ozark Cavefish: The project is within the recharge area for an Ozark Cavefish (*Troglichthys rosae*, federal listed threatened, state-listed endangered) site. All activities that might adversely impact groundwater quality should be avoided. Please see [Best Management Practices for Construction and Development Projects Ozark Cavefish \(mo.gov\)](#) and [Management Recommendations for Construction and Development Projects Affecting Missouri Karst Habitat \(mo.gov\)](#). Additional coordination with the U.S. Fish and Wildlife Service may be required for the project under the federal Endangered Species Act (U.S. Fish and Wildlife Service, Ecological Services, 101 Park DeVillie Drive, Suite A, Columbia, Missouri 65203-0007; phone 573-234-2132).

Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, and larvae may be moved to new sites on boats or construction equipment. Please inspect and clean equipment thoroughly before moving between project sites. See [Managing Invasive Species in Your Community | Missouri Department of Conservation \(mo.gov\)](#) for more information.

- Remove any mud, soil, trash, plants or animals from equipment before leaving any water body or work area.
- Drain water from boats and machinery that have operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
- When possible, wash and rinse equipment thoroughly with hard spray or HOT water (>140° F, typically available at do-it-yourself car wash sites), and dry in the hot sun before using again.

Streams and Wetlands – Clean Water Act Permits: Streams and wetlands in the project area should be protected from activities that degrade habitat conditions. For example, soil erosion, water pollution, placement of fill, dredging, in-stream activities, and riparian corridor removal, can modify or diminish aquatic habitats. Streams and wetlands may be protected under the Clean Water Act and require a permit for any activities that result in fill or other modifications to the site. Conditions provided within the U.S. Army Corps of Engineers (USACE) Clean Water Act Section 404 permit ([Kansas City District Regulatory Branch \(army.mil\)](#)) and the Missouri Department of Natural Resources (DNR) issued Clean Water Act Section 401 Water Quality Certification ([Section 401 Water Quality Certification | Missouri Department of Natural Resources \(mo.gov\)](#)), if required, should help minimize impacts to the aquatic organisms and aquatic habitat within the area. Depending on your project type, additional permits may be required by the Missouri Department of Natural Resources, such as permits for stormwater, wastewater treatment facilities, and confined animal feeding operations. Visit [Wastewater Permits | Missouri Department of Natural Resources \(mo.gov\)](#) for more information on DNR permits. Visit both the USACE and DNR for more information on Clean Water Act permitting.

For further coordination with the Missouri Department of Conservation and the U.S. Fish and Wildlife Services, please see the contact information below:

Email (preferred): NaturalHeritageReview@mdc.mo.gov
MDC Natural Heritage Review
Science Branch
P.O. Box 180
Jefferson City, MO
65102-0180
Phone: 573-522-4115 ext. 3182

U.S. Fish and Wildlife Service
Ecological Service
101 Park DeVillie Drive
Suite A
Columbia, MO
65203-0007
Phone: 573-234-2132

Miscellaneous Information

FEDERAL Concerns are species/habitats protected under the Federal Endangered Species Act and that have been known near enough to the project site to warrant consideration. For these, project managers must contact the U.S. Fish and Wildlife Service Ecological Services (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132; Fax 573-234-2181) for consultation.

STATE Concerns are species/habitats known to exist near enough to the project site to warrant concern and that are protected under the Wildlife Code of Missouri (RSMo 3 CSR 1 0). "State Endangered Status" is determined by the Missouri Conservation Commission under constitutional authority, with requirements expressed in the Missouri Wildlife Code, rule 3CSR 1 0-4.111. Species tracked by the Natural Heritage Program have a "State Rank" which is a numeric rank of relative rarity. Species tracked by this program and all native Missouri wildlife are protected under rule 3CSR 10-4.110 General Provisions of the Wildlife Code.

See [Missouri Species and Communities of Conservation Concern Checklist \(mo.gov\)](#) for a complete list of species and communities of conservation concern. Detailed information about the animals and some plants mentioned may be accessed at [Mofwis Search Results](#). Please contact the Missouri Department of Conservation to request printed copies of any materials linked in this document.



Missouri Department of Conservation
Natural Heritage Review Report

May 11, 2023

Science Branch
 P. O. Box 180
 Jefferson City, MO 65102
 Prepared by: Kelly Rezac
 NaturalHeritageReview@mdc.mo.gov
 (573) 522 - 4115 ext. 3182

Sean McKiernan
 Olsson
 smckiernan@olsson.com

NHR ERT ID:	12457	NHR ERT Level:	2
Project type:	Construction		
Location/Scope:	T23NR27WS21		
County:	Barry		
Project Title:	Cassville Performing Arts Center		
Query received:	3/27/2023		

This NATURAL HERITAGE REVIEW is not a site clearance letter. Rather, it identifies public lands and records of sensitive resources located close to and/or potentially affected by the proposed project. If project plans or location change, this report may no longer be valid. Because land use conditions change and animals move, the existence of an occurrence record does not mean the species/habitat is still present. Therefore, reports include information about records near but not necessarily on the project site. Lack of an occurrence record does not mean that a sensitive species or natural community is not present on or near the project area. On-site verification is the responsibility of the project. These records serve as one reference and additional information (e.g. wetland or soils maps, on-site inspections or surveys) should be considered. Look for additional information about the biological and habitat needs of records listed to avoid or minimize impacts. More information is at [Natural Areas | Missouri Department of Conservation \(mo.gov\)](#) and [Missouri Fish and Wildlife Information System \(MOFWIS\)](#).

Level 3: Records of federal-listed (also state-listed) species or critical habitats near the project site:

- **Ozark Cavefish:** The project is within the recharge area for an Ozark Cavefish (*Troglichthys rosae*, federal listed threatened, state-listed endangered) site. All activities that might adversely impact groundwater quality should be avoided. Please see [Best Management Practices for Construction and Development Projects Ozark Cavefish \(mo.gov\)](#) and [Management Recommendations for Construction and Development Projects Affecting Missouri Karst Habitat \(mo.gov\)](#).

FEDERAL LIST species/habitats are protected under the Federal Endangered Species Act. **Contact U.S. Fish & Wildlife Service** (101 Park Deville Drive Suite A, Columbia, Missouri 65203-0007; 573-234-2132) for Endangered Species Act coordination and concurrence information).

Level 2: Records of state-listed (not federal-listed) endangered species AND / OR state-ranked (not state-listed endangered) species and natural communities of conservation concern. The Department tracks these species and natural communities due to population declines and/or apparent vulnerability.

Natural Heritage records identify no state-listed endangered species within the project area.

Natural Heritage records indicate the following state-ranked species near the project area:

Scientific Name	Common Name	State Rank	Proximity (miles)	Primary Habitat
Ambystoma tigrinum	Eastern Tiger Salamander	S3	<2	Savanna/Shrub/Woodland matrix, Grassland matrix, Wetland matrix
Eurycea spelaea	Grotto Salamander	S2S3	<1	Cave, Spring/spring branch
Phrynosoma cornutum	Texas Horned Lizard	S2	<1	Grassland matrix
Trillium pusillum var. ozarkanum	Ozark Wake Robin	S2	<1	Woodland

State Rank Definitions:

- S1: Critically imperiled in the state because of extreme rarity of or because of some factor(s) making it especially vulnerable to extirpation from the state. Typically, 5 or fewer occurrences or very few remaining individuals (<1,000).
- S2: Imperiled in the state because of rarity or because of some factor(s) making it very vulnerable to extirpation from the state (6 to 20 occurrences or few remaining individuals).
- S3: Vulnerable in the state either because rare and uncommon, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extirpation. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.
- S4: Uncommon but not rare, and usually widespread in the nation or state. Possible cause of long-term concern. Usually more than 100 occurrences and more than 10,000 individuals.
- S#S#: Range Rank: A numeric range rank (e.g., S2S3) is used to indicate the range of uncertainty about the exact status.
- ?: Denotes inexact or uncertain numeric rank.
- SU: Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.

There are no regulatory requirements associated with this status, however we encourage voluntary stewardship to minimize the risk of further decline that could lead to listing.

STATE ENDANGERED species are protected under the Wildlife Code of Missouri (3CSR10-4.111).
See the [Missouri Species And Communities Of Conservation Concern Checklist \(mo.gov\)](#) for a complete list.

General recommendations related to this project or site, or based on information about the historic range of species (unrelated to any specific Natural Heritage records):

- **Construction:** The project should be managed to minimize erosion and sedimentation/runoff to nearby streams and lakes, including adherence to any Clean Water Act permit conditions ([Missouri DNR](#) or [US Army Corps of Engineers](#)). Revegetate areas in which the natural cover is disturbed to minimize erosion using native plant species compatible with the local landscape and wildlife needs. Annual ryegrass may be combined with native perennials for quicker green-up. Avoid aggressive exotic perennials such as crown vetch and sericea lespedeza. Pollutants, including sediment, can have significant impacts far downstream. Use silt fences and/or vegetative filter strips to buffer streams and drainages and monitor those after rain events and until a well-rooted ground cover is reestablished. Please see [Best Management Practices for Construction and Development Projects Affecting Missouri Rivers and Streams \(mo.gov\)](#).
- **Karst:** Barry County has known karst geologic features (e.g. caves, springs, and sinkholes, all characterized by subterranean water movement). Few karst features are recorded in Natural Heritage records, and ones not noted here may be encountered at the project site or affected by the project. Cave fauna (many of which are species of conservation concern) are influenced by changes to water quality, so check your project site for any karst features and make every effort to protect groundwater in the project area. Please see [Management Recommendations for Construction and Development Projects Affecting Missouri Karst Habitat \(mo.gov\)](#).
- **Indiana Bats and Northern Long-eared Bats:** If this project has the potential to alter habitat (e.g. tree removal, projects in karst habitat) or cause direct mortality of bats, please coordinate directly with U.S. Fish and Wildlife Service (Ecological Services, 101 Park

Deville Drive, Suite A, Columbia, Missouri 65203-0007; Phone 573-234-2132 Ext. 100 for Ecological Services) for further coordination under the Endangered Species Act.

Though Indiana are not known to occur in the project area, these species should be assumed present wherever habitat exists, and though Northern Long-eared bats are not known to occur in the project area, these species should be assumed present because they occur in Barry County and could occur in the project area. Indiana Bats (*Myotis sodalis*, federal and state-listed endangered) and Northern Long-eared Bats (*Myotis septentrionalis*, federal-listed endangered) hibernate during winter months in caves and mines. During the summer months, they roost and raise young under the bark of trees in riparian forests and upland forests near perennial streams. During project activities, avoid degrading stream quality and where possible leave snags standing and preserve mature forest canopy. Do not enter caves known to harbor Indiana Bats and/or Northern Long-eared Bats, especially from September to April.

- **Gray Bats:** Gray Bats (*Myotis grisescens*, federal and state-listed endangered) occur in Barry County and could occur in the project area, as they forage over streams, rivers, and reservoirs. Avoid entry or disturbance of any cave inhabited by gray bats and when possible retain forest vegetation along the stream and from the gray bat cave opening to the stream. Please see [Best Management Practices for Construction and Development Projects Gray bat \(mo.gov\)](#).
- Invasive exotic species are a significant issue for fish, wildlife and agriculture in Missouri. Seeds, eggs, larvae, and aquatic plant material may be moved to new sites on boats or construction equipment, so inspect and clean equipment thoroughly before moving between project sites.
 - Remove any mud, soil, trash, plants (or plant material) or animals from equipment before leaving any water body or work area.
 - Drain water from boats and machinery that has operated in water, checking motor cavities, live-well, bilge and transom wells, tracks, buckets, and any other water reservoirs.
 - When possible, wash and rinse equipment thoroughly with hard spray or HOT water ($\geq 140^{\circ}$ F, typically available at do-it-yourself carwash sites), and dry in the hot sun before using again.

These recommendations are ones project managers might prudently consider based on a general understanding of species needs and landscape conditions. Natural Heritage records largely reflect sites visited by specialists in the last 30 years. Many privately owned tracts have not been surveyed and could host remnants of species once but no longer common.

MISSOURI



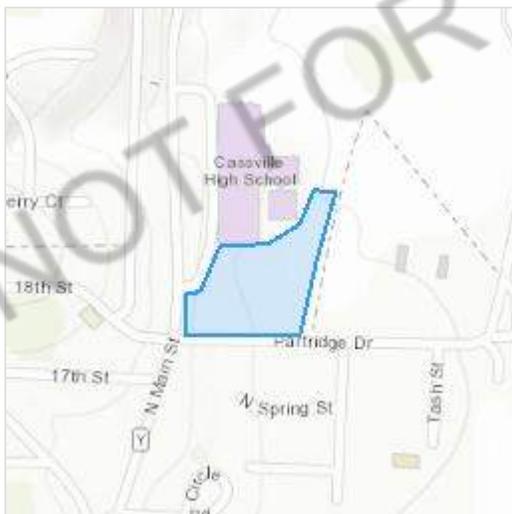
IPaC resource list

This report is an automatically generated list of species and other resources such as critical habitat (collectively referred to as *trust resources*) under the U.S. Fish and Wildlife Service's (USFWS) jurisdiction that are known or expected to be on or near the project area referenced below. The list may also include trust resources that occur outside of the project area, but that could potentially be directly or indirectly affected by activities in the project area. However, determining the likelihood and extent of effects a project may have on trust resources typically requires gathering additional site-specific (e.g., vegetation/species surveys) and project-specific (e.g., magnitude and timing of proposed activities) information.

Below is a summary of the project information you provided and contact information for the USFWS office(s) with jurisdiction in the defined project area. Please read the introduction to each section that follows (Endangered Species, Migratory Birds, USFWS Facilities, and NWI Wetlands) for additional information applicable to the trust resources addressed in that section.

Location

Barry County, Missouri



Local office

Missouri Ecological Services Field Office

☎ (573) 234-2132

📅 (573) 234-2181

101 Park Deville Drive

101 Park Avenue Drive
Suite A

Columbia, MO 65203-0057

NOT FOR CONSULTATION

Endangered species

This resource list is for informational purposes only and does not constitute an analysis of project level impacts.

The primary information used to generate this list is the known or expected range of each species. Additional areas of influence (AOI) for species are also considered. An AOI includes areas outside of the species range if the species could be indirectly affected by activities in that area (e.g., placing a dam upstream of a fish population even if that fish does not occur at the dam site, may indirectly impact the species by reducing or eliminating water flow downstream). Because species can move, and site conditions can change, the species on this list are not guaranteed to be found on or near the project area. To fully determine any potential effects to species, additional site-specific and project-specific information is often required.

Section 7 of the Endangered Species Act **requires** Federal agencies to "request of the Secretary information whether any species which is listed or proposed to be listed may be present in the area of such proposed action" for any project that is conducted, permitted, funded, or licensed by any Federal agency. A letter from the local office and a species list which fulfills this requirement can **only** be obtained by requesting an official species list from either the Regulatory Review section in IPaC (see directions below) or from the local field office directly.

For project evaluations that require USFWS concurrence/review, please return to the IPaC website and request an official species list by doing the following:

1. Draw the project location and click CONTINUE.
2. Click DEFINE PROJECT.
3. Log in (if directed to do so).
4. Provide a name and description for your project.
5. Click REQUEST SPECIES LIST.

Listed species¹ and their critical habitats are managed by the [Ecological Services Program](#) of the U.S. Fish and Wildlife Service (USFWS) and the fisheries division of the National Oceanic and Atmospheric Administration (NOAA Fisheries²).

Species and critical habitats under the sole responsibility of NOAA Fisheries are **not** shown on this list. Please contact [NOAA Fisheries](#) for [species under their jurisdiction](#).

-
1. Species listed under the [Endangered Species Act](#) are threatened or endangered; IPaC also shows species that are candidates, or proposed, for listing. See the [listing status page](#) for more information. IPaC only shows species that are regulated by USFWS (see FAQ).

2. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

The following species are potentially affected by activities in this location:

Mammals

NAME	STATUS
<p>Gray Bat <i>Myotis grisescens</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6329</p>	Endangered
<p>Indiana Bat <i>Myotis sodalis</i> Wherever found There is final critical habitat for this species. Your location does not overlap the critical habitat. https://ecos.fws.gov/ecp/species/5949</p>	Endangered
<p>Northern Long-eared Bat <i>Myotis septentrionalis</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9045</p>	Threatened
<p>Ozark Big-eared Bat <i>Corynorhinus (=Plecotus) townsendii</i> <i>ingens</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/7245</p>	Endangered
<p>Tricolored Bat <i>Perimyotis subflavus</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/10515</p>	Proposed Endangered

Fishes

NAME	STATUS
<p>Ozark Cavefish <i>Amblyopsis rosae</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/6490</p>	Threatened

Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> Wherever found No critical habitat has been designated for this species. https://ecos.fws.gov/ecp/species/9743	Candidate

Critical habitats

Potential effects to critical habitat(s) in this location must be analyzed along with the endangered species themselves.

There are no critical habitats at this location.

Migratory birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

1. The [Migratory Birds Treaty Act](#) of 1918.
2. The [Bald and Golden Eagle Protection Act](#) of 1940.

Additional information can be found using the following links:

- Birds of Conservation Concern <https://www.fws.gov/program/migratory-birds/species>
- Measures for avoiding and minimizing impacts to birds
<https://www.fws.gov/library/collections/avoiding-and-minimizing-incident-take-migratory-birds>
- Nationwide conservation measures for birds
<https://www.fws.gov/sites/default/files/documents/nationwide-standard-conservation-measures.pdf>

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this

location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Rusty Blackbird <i>Euphagus carolinus</i> This is a Bird of Conservation Concern (BCC) only in particular Bird Conservation Regions (BCRs) in the continental USA	Breeds elsewhere

Probability of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum

What does IPaC use to generate the list of migratory birds that potentially occur in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [Rapid Avian Information Locator \(RAIL\) Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go to the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering or migrating in my area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may query your location using the [RAIL Tool](#) and look at the range maps provided for birds in your area at the bottom of the profiles provided for each bird in your results. If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

Facilities

National Wildlife Refuge lands

Any activity proposed on lands managed by the [National Wildlife Refuge](#) system must undergo a 'Compatibility Determination' conducted by the Refuge. Please contact the individual Refuges to discuss any questions or concerns.

There are no refuge lands at this location.

Fish hatcheries

There are no fish hatcheries at this location.

Wetlands in the National Wetlands Inventory (NWI)

Impacts to [NWI wetlands](#) and other aquatic habitats may be subject to regulation under Section 404 of the Clean Water Act, or other State/Federal statutes.

For more information please contact the Regulatory Program of the local [U.S. Army Corps of Engineers District](#).

Wetland information is not available at this time

This can happen when the National Wetlands Inventory (NWI) map service is unavailable, or for very large projects that intersect many wetland areas. Try again, or visit the [NWI map](#) to view wetlands at this location.

Data limitations

The Service's objective of mapping wetlands and deepwater habitats is to produce reconnaissance level information on the location, type and size of these resources. The maps are prepared from the analysis of high altitude imagery. Wetlands are identified based on vegetation, visible hydrology and geography. A margin of error is inherent in the use of imagery; thus, detailed on-the-ground inspection of any particular site may result in revision of the wetland boundaries or classification established through image analysis.

The accuracy of image interpretation depends on the quality of the imagery, the experience of the image analysts, the amount and quality of the collateral data and the amount of ground truth verification work conducted. Metadata should be consulted to determine the date of the source imagery used and any mapping problems.

Wetlands or other mapped features may have changed since the date of the imagery or field work. There may be occasional differences in polygon boundaries or classifications between the information depicted on the map and the actual conditions on site.

Data exclusions

Certain wetland habitats are excluded from the National mapping program because of the limitations of aerial imagery as the primary data source used to detect wetlands. These habitats include seagrasses or submerged aquatic vegetation that are found in the intertidal and subtidal zones of estuaries and nearshore coastal waters. Some deepwater reef communities (coral or tubercid worm reefs) have also been excluded from the inventory. These habitats, because of their depth, go undetected by aerial imagery.

Data precautions

Federal, state, and local regulatory agencies with jurisdiction over wetlands may define and describe wetlands in a different manner than that used in this inventory. There is no attempt, in either the design or products of this inventory, to define the limits of proprietary jurisdiction of any Federal, state, or local government or to establish the geographical scope of the regulatory programs of government agencies. Persons intending to engage in activities involving modifications within or adjacent to wetland areas should seek the advice of appropriate Federal, state, or local agencies concerning specified agency regulatory programs and proprietary jurisdictions that may affect such activities.

SECTION 11

Historic Preservation Documentation

Section 106 of the 1966 National Historic Preservation Act (as amended) aims to protect historic and cultural properties from unintentional federal action. A federal action can be through a permit, license or funding. If the preceding situations do not apply to this project a Section 106 review is not required. The permittee must still comply with relevant state and local regulations.



[Things to Do](#)
[Make a Reservation](#)
[Find My Park](#)

BARRY COUNTY NATIONAL REGISTER LISTINGS

Camp Smokey/Company 1713 Historic District (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (2/26/85)

Cassville Ranger Station Historic District (*Historic and Architectural Resources of the Mark Twain National Forest MPDF*), MO 248, Cassville (8/04/03)

Courdin House , Old, 2.4 miles southeast of Monett (11/05/71)

Downtown Monett Historic District , parts of the 200-400 blocks of Broadway and Bond, Monett vicinity (6/27/14)

McMurtry Spring and Trail of Tears Roadbed Segment (*Cherokee Trail of Tears in Missouri, 1837-1839 MPDF*), address restricted, Cassville vicinity (7/23/18)

Natural Bridge Archaeological Site, address restricted (5/05/72)

Roaring River State Park Bath House (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (3/04/85)

Roaring River State Park Dam/Spillway (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (2/28/85)

Roaring River State Park Deer Leap Trail (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (2/26/85)

Roaring River State Park Honeymoon Cabin (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (2/26/85)

Roaring River State Park Hotel (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (3/04/85)

Roaring River State Park Shelter Kitchen No. 2 and Rest Room (*ECW Architecture in Missouri State Parks, 1933-1942 TR*), Cassville vicinity off Park Road (2/26/85)

Southwest Missouri Prehistoric Rock Shelter and Cave Sites Discontiguous Archeological District (*Prehistoric Rock Shelter and Cave and Cave Sites in Southwestern Missouri MPDF*), address restricted (10/24/91)

Tom Town Historic District ([map](#) [see [note](#)]), off County Road W, south of Pleasant Ridge, Pleasant Ridge vicinity (12/15/89)

Waldensain Church and Cemetery of Stone Prairie , Route 2, Monett vicinity (1/18/85)

Wheaton Missouri and North Arkansas Railroad Depot , junction of Main and Barnett streets, Wheaton, Barry County (2/10/00)

Each **bold-faced** link in the list above leads to a word-searchable NATIONAL REGISTER NOMINATION for that resource; other links provide maps or additional context for the resource. The items may be downloaded (right-click) or viewed in your Web browser (double-click). File sizes range from 1 MB to several hundred MB. The time required for loading will depend on your connection speed. You may obtain a free copy of Adobe Reader software required to read the materials by visiting our [Help page](#).

RELATED CONTENT

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[Acronym Key](#)

STATE HISTORIC PRESERVATION OFFICE

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[NR Nominations by County](#)
[Survey](#)
[Architectural Survey](#)
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THINGS TO KNOW

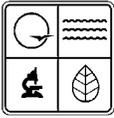
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*Missouri State Parks – a division of the
Missouri Department of Natural Resources*



MISSOURI DEPARTMENT OF NATURAL RESOURCES
STATE HISTORIC PRESERVATION OFFICE
SECTION 106 PROJECT INFORMATION FORM

Submission of a completed Project Information Form with adequate information and attachments constitutes a request for a review pursuant to Section 106 of the National Historic Preservation Act of 1966 (as amended). We reserve the right to request more information. **Please refer to the CHECKLIST on Page 2 to ensure that all basic information relevant to the project has been included.** For further information, refer to our website at: <http://dnr.mo.gov/shpo> and follow the links to Section 106 Review.

NOTE: Section 106 regulations provide for a 30-day response time by the Missouri State Historic Preservation Office from the date of receipt.

PROJECT NAME

FEDERAL AGENCY PROVIDING FUNDS, LICENSE, OR PERMIT

APPLICANT

TELEPHONE

CONTACT PERSON

TELEPHONE

ADDRESS FOR RESPONSE

LOCATION OF PROJECT

COUNTY

STREET ADDRESS

CITY

LEGAL DESCRIPTION OF PROJECT AREA (TOWNSHIP, RANGE, SECTION, ¼ SECTION)

USGS TOPOGRAPHIC MAP QUADRANGLE NAME (SEE MAP REQUIREMENTS ON PAGE 2)

YEAR

TOWNSHIP

RANGE

SECTION

PROJECT DESCRIPTION

DESCRIBE THE OVERALL PROJECT IN DETAIL. IF IT INVOLVES EXCAVATION, INDICATE HOW WIDE, HOW DEEP, ETC. IF THE PROJECT INVOLVES DEMOLITION OF EXISTING BUILDINGS, MAKE THAT CLEAR. IF THE PROJECT INVOLVES REHABILITATION, DESCRIBE THE PROPOSED WORK IN DETAIL. USE ADDITIONAL PAGES IF NECESSARY.

ARCHAEOLOGY (EARTHMOVING ACTIVITIES)

HAS THE GROUND INVOLVED BEEN GRADED, BUILT ON, BORROWED, OR OTHERWISE DISTURBED? PLEASE DESCRIBE IN DETAIL (USE ADDITIONAL PAGES, IF NECESSARY) PHOTOGRAPHS ARE HELPFUL:

WILL THE PROJECT REQUIRE FILL MATERIAL? YES NO

IF YES, INDICATE PROPOSED BORROW AREAS (SOURCE OF FILL MATERIAL) ON TOPOGRAPHIC MAP

ARE YOU AWARE OF ARCHAEOLOGICAL SITES ON OR ADJACENT TO PROJECT AREA? YES NO

IF YES, IDENTIFY THEM ON THE TOPOGRAPHIC MAP

STRUCTURES (REHABILITATION, DEMOLITION, ADDITIONS TO, OR CONTRUCTION NEAR EXISTING STRUCTURES)

TO THE BEST OF YOUR KNOWLEDGE, IS THE STRUCTURE LOCATED IN ANY OF THE FOLLOWING?

AN AREA PREVIOUSLY SURVEYED FOR HISTORIC PROPERTIES.

A NATIONAL REGISTER DISTRICT

A LOCAL HISTORIC DISTRICT

IF YES, PLEASE PROVIDE THE NAME OF THE SURVEY OR DISTRICT:

IF YES, PLEASE PROVIDE THE NAME OF THE SURVEY OR DISTRICT:

IF YES, PLEASE PROVIDE THE NAME OF THE SURVEY OR DISTRICT:

- PLEASE PROVIDE PHOTOGRAPHS OF ALL STRUCTURES, SEE PHOTOGRAPHY REQUIREMENTS
- **NOTE:** ALL PHOTOGRAPHS SHOULD BE LABELED AND KEYED TO ONE MAP OF THE PROJECT AREA
- PLEASE PROVIDE A BRIEF HISTORY OF THE BUILDING(S), INCLUDING CONSTRUCTION DATES AND BUILDING USES. (USE ADDITIONAL PAGES, IF NECESSARY.)

ADDITIONAL REQUIREMENTS

Map Requirements: Attach a copy of the relevant portion (8 1/2 x 11) of the current USGS 7.5 min. topographic map **and**, if necessary, a large scale project map. Please do not send an individual map with each structure or site. While an original map is preferable, a good copy is acceptable. For a list of sites from which to order, download or print the required USGS 7.5 min. topographic maps at little or no cost, consult <http://dnr.mo.gov/shpo/sectionrev.htm> .

Photography Requirements: Clear black and white or color photographs (minimum 3" x 5") are acceptable. Polaroids, photocopies, emailed or faxed photographs are not acceptable. **Good quality photographs are important for expeditious project review.** Photographs of neighboring or nearby buildings are also helpful. All photographs should be labeled and keyed to one map of the project area.

CHECKLIST-DID YOU PROVIDE THE FOLLOWING INFORMATION?

Topographic map 7.5 min. (per project, not structure)

Other supporting documents (If necessary to explain the project)

Thorough description (all projects)

For new construction, rehabilitations, etc., attach work write-ups, plans, drawings, etc.

Photographs (all structures)

Is topographic map identified by quadrangle and year?

Return this Form and Attachments to:

**MISSOURI DEPARTMENT OF NATURAL RESOURCES
STATE HISTORIC PRESERVATION OFFICE
Attn: Section 106 Review
P.O. BOX 176
JEFFERSON CITY, MISSOURI 65102-0176**

SECTION 12

Inspection Reports

- Log of Inspections
- Inspection Reports
- Inspector Credentials

SECTION 13

Regulatory Correspondence

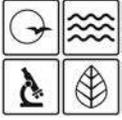
Pertinent correspondence from regulatory agencies relating to this project can be located here.

SECTION 14

Notice of Termination

This section contains the Notice of Termination form for the project. The form should be filled out, signed and sent to the applicable MDNR regional office (see map).

Documentation of acceptance from the DNR should also be kept here and all documents must be retained for 3 years after the date of NOT acceptance.



MISSOURI DEPARTMENT OF NATURAL RESOURCES
 WATER PROTECTION PROGRAM, WATER POLLUTION CONTROL BRANCH
REQUEST FOR TERMINATION OF OPERATING PERMIT
 (REPLACES TERMINATION FORMS H AND J)

FOR OFFICE USE ONLY

DATE RECEIVED

IF A FACILITY OR SITE HAS BEEN SOLD, BUT PERMITTED ACTIVITIES HAVE NOT CEASED, A TRANSFER OF OWNERSHIP FORM (MO 780-1517) MUST BE COMPLETED RATHER THAN A TERMINATION FORM.

ALL APPLICABLE SECTIONS OF THIS FORM MUST BE COMPLETED.

1. FACILITY INFORMATION

PERMIT NUMBER		COUNTY	
NAME OF FACILITY			
PHYSICAL ADDRESS		CITY	STATE ZIP CODE
FACILITY CONTACT NAME	FACILITY CONTACT TELEPHONE NUMBER	FACILITY CONTACT EMAIL	

2. OWNER

NAME		TELEPHONE NUMBER WITH AREA CODE	
ADDRESS		CITY	STATE ZIP CODE
EMAIL			

3. CONTINUING AUTHORITY

NAME		TELEPHONE NUMBER WITH AREA CODE	
ADDRESS		CITY	STATE ZIP CODE
EMAIL			

4. REASON FOR TERMINATION REQUEST (CHECK ONE)

- Permitted activities have ceased, or facility is closed (must select facility type in section five and attach photographs or any other supporting documents as required).
- General Permit MO-G _____ or MO-R _____ has been issued and covers all regulated activities.
- Site specific permit MO- _____ has been issued and covers all regulated activities.
- Facility has obtained a "No Exposure" certification, MO-NX _____.
- Industrial activity (SIC Code # _____) is not regulated.
- For CAFOs, facility size is unregulated (Class II and smaller operations only).
- Other (Specify).

5. FACILITY TYPE (CHECK ONE FACILITY TYPE, COMPLETE ONLY IF PERMITTED ACTIVITY HAS CEASED OR FACILITY HAS CLOSED)

- For land disturbance sites, the area is stabilized; perennial vegetation, pavement, buildings or other permanent structures cover all areas that have been disturbed; no further land disturbance activities are planned; all building construction (commercial or residential) is completed; temporary best management practices are removed, and construction equipment is removed. With respect to areas that have been vegetated, vegetation cover shall be at least 70 percent over 100 percent of the site not covered in impervious material. Attach photographs showing stabilized areas.
- For wastewater treatment plants, the treatment plant is removed and sludge was removed and properly disposed of, and a closure plan in accordance with [10 CSR 20-6.010\(12\)](#) or [10 CSR 20-6.015\(5\)](#) was approved and implemented. Attach documentation required by the approved closure plan and photographs of the closed area. See the *Water Treatment Plant Closure* -PUB2568 fact sheet at dnr.mo.gov/pubs/pub2568.htm for more information on closure requirements for wastewater treatment plants.
- For industrial facilities, regulated activities have ceased, no "significant materials" remain on-site and disturbed areas are properly stabilized or vegetated. The area is stabilized when perennial vegetation, pavement, buildings or structures using permanent materials cover all areas that have been disturbed. Vegetation cover shall be at least 70 percent over 100 percent of the site not covered in impervious material. Attach applicable closure documents and photographs of the closed area that demonstrate no permitted activities or materials remain.
- For quarries or sand and gravel operations, submit documentation of release from the department's Land Reclamation Program.
- For landfills, official closure has been received from department's Solid Waste Management Program (SWMP); cap is vegetated as required by SWMP; and any additional industrial activities are permitted appropriately (i.e., transfer stations, mulching operations, land disturbance, etc.). Attach the official SWMP closure letter and permit numbers of any continuing active industrial or land disturbance activities.
- For CAFOs
 - Class I CAFOs must properly close lagoons and waste storage structures per a closure plan in accordance with [10 CSR 20-6.300\(6\)](#) and approved by the department. Attach photographs of closed lagoons. Also attach any additional information that supports closure of the facility.
 - Class II CAFOs must close waste storage structures in accordance with [10 CSR 20-6.300\(6\)\(B\)](#), or shall continue to maintain all storage structures so there is no discharge to waters of the state. Attach photographs of closed or re-purposed lagoons, or an explanation of "no discharge" methods. Also attach any additional information that supports closure of the facility.

6. CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

NAME AND OFFICIAL TITLE (TYPE OR PRINT)	TELEPHONE NUMBER WITH AREA CODE
SIGNATURE	DATE SIGNED

7. MAIL COMPLETED COPY TO:

<p>For Site Specific (MO-), Abandoned Mine And Land Reclamation (MO-G05), Land Disturbance By County Or City (MO-R100), Pesticide Application (MO-G87), Sewer Extension Construction (MO-GC) and CAFO (MO-G01, MO-GS1) Permit Terminations:</p> <p>Missouri Department of Natural Resources Water Protection Program Water Pollution Control Branch Attn: Operating Permits Section P.O. Box 176 Jefferson City, MO 65102-0176</p>	<p>For General Permit Terminations (MO-G or MO-R):</p> <p>Send to the appropriate regional office. Regional office is determined based on the county where the facility is physically located.</p> <p>To determine the correct regional office for the permitted facility, see dnr.mo.gov/regions.</p>
--	--



MISSOURI DEPARTMENT OF NATURAL RESOURCES

Division of Environmental Quality Regional Offices

Kansas City Area

Kansas City Regional Office
 500 NE Colbern Rd.
 Lee's Summit, MO 64086-4710
 816-251-0700 FAX: 816-622-7044

St. Louis Area

St. Louis Regional Office
 7545 S. Lindbergh, Ste 210
 St. Louis, MO 63125
 314-416-2960 FAX: 314-416-2970

Northeast Area

Northeast Regional Office
 1709 Prospect Drive
 Macon, MO 63552-2602
 660-385-8000 FAX: 660-385-8090

Southwest Area

Southwest Regional Office
 2040 W. Woodland
 Springfield, MO 65807-5912
 417-891-4300 FAX: 417-891-4399

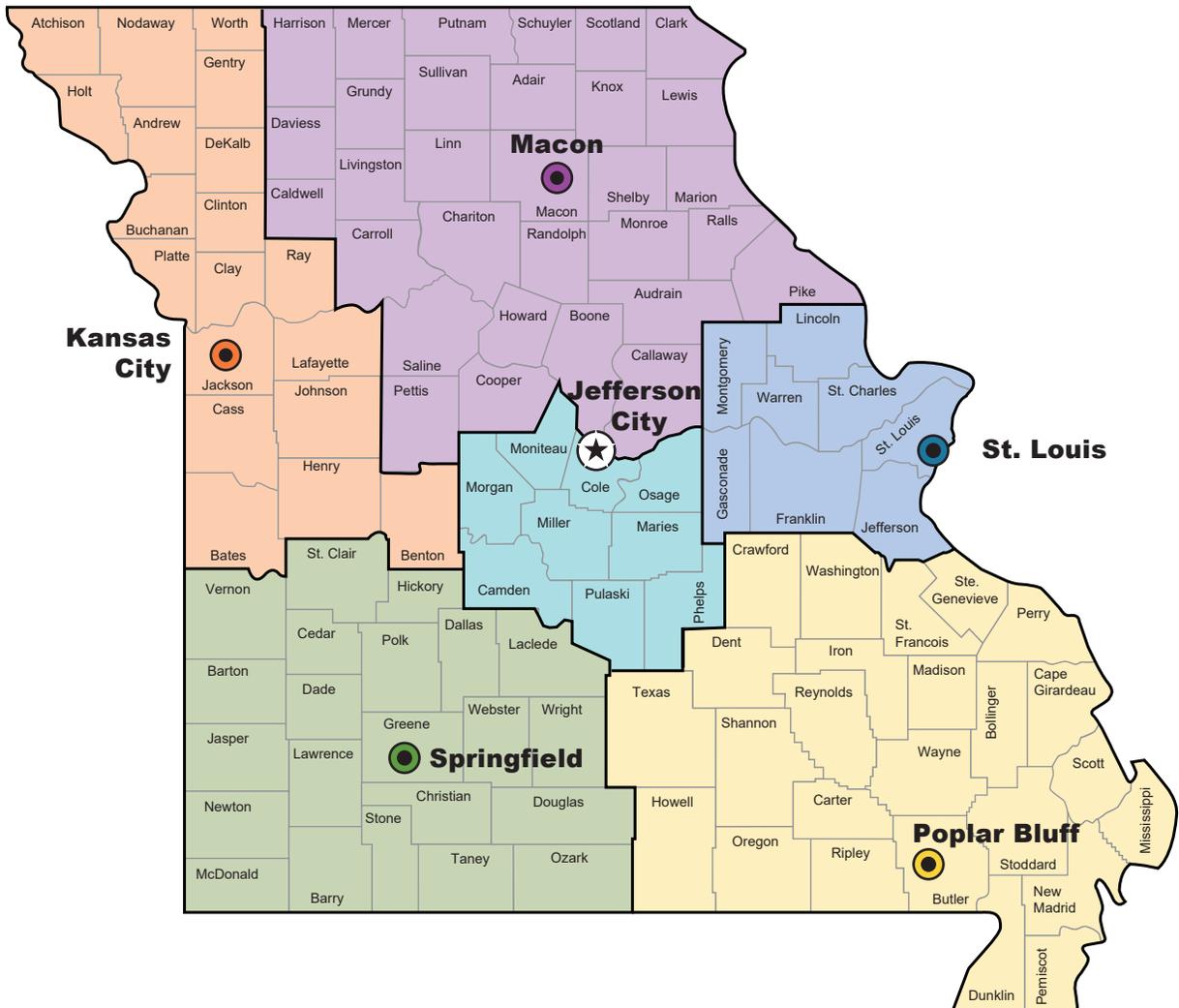
Southeast Area

Southeast Regional Office
 2155 North Westwood Blvd.
 Poplar Bluff, MO 63901
 573-840-9750 FAX: 573-840-9754

Central Area

Department Central Offices
 P.O. Box 176
 Jefferson City, MO 65102-0176
 573-751-3443

Central Field Operations
 P.O. Box 176
 Jefferson City, MO 65102-0176
 573-522-3322 FAX: 573-522-3522





Geotechnical Engineering Report

**Cassville High School Performing Arts Center
Cassville, Missouri**

January 6, 2023

Terracon Project No. B5225065

Prepared for:

Paragon Architecture LLC
Springfield, Missouri

Prepared by:

Terracon Consultants, Inc.
Springfield, Missouri



January 6, 2023

Paragon Architecture LLC
637 W. College Street
Springfield, Missouri 65806



Attn: Ms. Kirsten Whitehead, AIA
P: (417) 885 0002
E: whitehead@paragonarchitecture.com

Re: Geotechnical Engineering Report
Cassville High School Performing Arts Center
1825 State Hwy Y
Cassville, Missouri
Terracon Project No. B5225065

Dear Ms. Whitehead:

We have completed a subsurface exploration and geotechnical engineering exploration for the referenced project. This study was performed in general accordance with Terracon Proposal No. PB5225065, dated November 7, 2022 and the Supplement to the Agreement for Services, dated December 27th, 2022. This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations and floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,
Terracon Consultants, Inc.

A handwritten signature in black ink, appearing to read "Ripken B. Dodson".

Ripken B. Dodson, E.I.
Geotechnical Staff Engineer



Ty G. Alexander, P.E.
Office Manager/Principal
Missouri: PE-2009002087

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Note: This report was originally delivered in a web-based format. For more interactive features, please view your project online at client.terracon.com.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES
SITE LOCATION AND EXPLORATION PLANS
GEOLOGIC MAP
EXPLORATION RESULTS
SUPPORTING INFORMATION

Note: Refer to each individual Attachment for a listing of contents.

REPORT SUMMARY

A geotechnical exploration has been performed for the proposed Cassville High School Performing Arts Center located at 1825 State Hwy Y in Cassville, Missouri. Nine (9) borings, designated B-1 through B-9, were performed to depths of approximately 10 to 31½ feet below the existing ground surface. Six (6) test pits designated TP-1 through TP-6 were performed to depths of approximately 4 to 13 feet below the existing ground surface. The following geotechnical considerations were identified:

- Existing undocumented fill was encountered at each of the boring locations to depths ranging from approximately 3 to 5 feet. Foundations for the proposed building should not bear on or above the undocumented fill materials. Any existing fill should be removed and replaced (or improved) so foundations and floor slabs for the building bear on suitable native soils or on properly placed and compacted engineered fill extending to the suitable native soils.
- Due to the clayey gravels and sands encountered in the soil exploration program, differentiating native soils from man-placed fill material is difficult. Materials in question were labeled as possible fill in the boring logs. This material needs to be carefully observed and documented by a Terracon representative to confirm the extent of the fill material. We recommend test pits be performed in these areas to further evaluate expected fill composition and depth.
- Provided the owner is willing to accept the risks associated with supporting pavements over the existing fill materials in exchange for reduced construction costs, portions of the existing fill could be left in place for support of new pavements. At least 12 inches of new engineered fill should be placed directly below the pavements, respectively, with this option.
- Soft soils were encountered to depths of 25 feet below existing grade in boring B-2. To reduce total and differential settlement in this portion of the building, overexcavation of existing soils and or augmenting the existing soils with an aggregate pier foundation system will be required. The extent of the area to be overexcavated or augmented should be further evaluated utilizing supplemental test pits and/or drilling.
- The construction of the new additions will increase stress on the existing soils. The increase in stress will cause additional settlement of the existing structures. Additionally, some differential settlement of the new additions and the existing structures should be anticipated. Means to reduce the additional settlement and account for the differential settlement have been included in this report.
- The fat clay (CH) soils encountered in the soil exploration program are high in plasticity and prone to volume change with variations in moisture content. For this reason, we recommend

Geotechnical Engineering Report

Cassville High School Performing Arts Center ■ Cassville, Missouri

January 6, 2023 ■ Terracon Project No. B5225065



a 24-inch thick Low Volume Change (LVC) zone be maintained or constructed beneath grade-supported floor slabs.

- Based on our borings, the International Building Code (IBC) seismic site class for this site is C.

The professional opinions and recommendations presented in this report are based on evaluation of data developed by testing discrete samples obtained from widely-spaced borings. Site subsurface conditions have been inferred from available data, but actual subsurface conditions will only be revealed by excavation. So that variations in subsurface conditions which may affect the design can be addressed as they are encountered, we recommend that Terracon be retained to observe excavations and perform tests during the site preparation, earthwork and foundation construction phases of the project.

This executive summary should not be separated from or used apart from this report. This report presents fully developed recommendations and opinions based on our understanding of the project at the time the report was prepared. The report limitations are described in the **General Comments** section of this report.

Geotechnical Engineering Report
Cassville High School Performing Arts Center
1825 State Hwy Y
Cassville, Missouri
Terracon Project No. B5225065
January 6, 2023

INTRODUCTION

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Cassville High School Performing Arts Center to be located at 1825 State Hwy Y in Cassville, Missouri. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- Site preparation and earthwork
- Pavement design and construction
- Excavation considerations
- Foundation design and construction
- Floor slab design and construction
- Seismic site classification
- Lateral earth pressures

The geotechnical engineering services for this project included the advancement of nine (9) test borings to depths ranging from approximately 10 to 31½ feet below existing site grades and six (6) test pits to depths ranging from approximately 4 to 13 feet below existing site grades.

Maps showing the site and boring locations are shown in the **Site Location** and **Exploration Plan** sections, respectively. The results of the laboratory testing performed on soil samples obtained from the site during the field exploration are included on the boring logs and/or as separate pages in the **Exploration Results** section.

The **General Comments** section provides an understanding of the report limitations.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

Geotechnical Engineering Report

Cassville High School Performing Arts Center ■ Cassville, Missouri

January 6, 2023 ■ Terracon Project No. B5225065



Item	Description
Parcel Information	The project is located at 1825 State Hwy Y in Cassville, Missouri. The approximate coordinates of the site are: Lat.: 36.6893° N Long.: 93.8627° W (See Site Location)
Existing Improvements	Undeveloped grass lot with the high school building and rear driveway adjacent to the lot
Current Ground Cover	Grass
Existing Topography	Site slopes from 1325 feet on the west side of the proposed addition to 1305 feet on the east side.
Geology	Based on the Geological Map of Missouri prepared by the Missouri Department of Natural Resources (MDNR), the subject site is located over the Osagean Series Limestone Bedrock Units. The Osagean Series Bedrock Unit is composed primarily of limestone and some chert.
Geological Concerns	Solution features, including springs, caves, and sinkholes, are commonly present in the Osagean Series Bedrock Unit in this area. Based on the review of information available from Missouri Department of Natural Resources databases, the subject site does not contain any previously identified sinkhole formations, although sinkholes and springs are noted on the Geologic Map in the vicinity of the site. It is difficult to predict future sinkhole activity. Site grading and drainage may alter site conditions and could possibly cause sinkholes in areas that have no history of this activity.

PROJECT DESCRIPTION

The table below presents a summary of our project understanding. This summary has been used as the basis of our analyses and recommendations. Any changes to this summary should be made known to Terracon immediately so revisions can be provided if necessary.

Item	Description
Information Provided	Information was provided by Ms. Kirsten Whitehead, AIA, with Paragon.
Project Description	Addition on south end of Cassville High School building that houses the performing arts center. Parking to the south of the addition.
Proposed Structure	The project includes a single-story building with a footprint of about 28,000 square feet. The building will be slab-on-grade (non-basement).
Building Construction	Pre-engineered metal building structure, slab-on-grade
Finished Floor Elevation	The FFE will vary from 1314 to 1321 due to slope of auditorium. FFE will match existing building at tie-in locations.

Item	Description
Maximum Loads (Estimated)	<p>Anticipated structural loads for the building were not provided. In preparing this report, we have considered the following maximum loads:</p> <ul style="list-style-type: none"> ■ Columns: 150 kips ■ Walls: 5-8 kips per linear foot (klf) ■ Slabs: 150 pounds per square foot (psf)
Grading/Slopes	<p>Up to 6 feet of cut and/or fill may be required to develop final grade. Final slope angles of as steep as 3H:1V (Horizontal: Vertical) are expected.</p>
Below-Grade Structures	None planned
Free-Standing Retaining Walls	Retaining walls expected on east side of the proposed addition. Wall heights of up to 7 feet are anticipated.
Below-Grade Areas	None planned.
Pavements	<p>New pavements will be constructed. We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered.</p> <p>Anticipated traffic (estimated by Terracon and confirmed by Paragon) is as follows:</p> <ul style="list-style-type: none"> ■ Autos/light trucks: 200 vehicles per day ■ School bus: 10 per day ■ Light delivery and trash collection vehicles: 5 vehicles per week ■ Tractor-trailer trucks: 0 vehicles per week <p>The pavement design period is 20 years.</p>

GEOTECHNICAL CHARACTERIZATION

We have developed a general characterization of the subsurface conditions based upon the subsurface exploration, laboratory data, geologic setting and our understanding of the project. This characterization, termed GeoModel, forms the basis of our geotechnical calculations and evaluation of site preparation and foundation options. Conditions encountered at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results** section and the GeoModel can be found in the **Figures** section of this report.

As part of our analyses, we identified the following model layers within the subsurface profile. For a more detailed view of the model layer depths at each boring location, refer to the GeoModel.

Model Layer	Layer Name	General Description
1	Fill Material	Fill material-sandy and/or gravelly lean clay or clayey sand with gravel
2	Lean Clay	Brown lean clay with trace amounts of sand and gravel
3	Sandy/Gravelly Lean Clay	Sandy or gravelly lean clay

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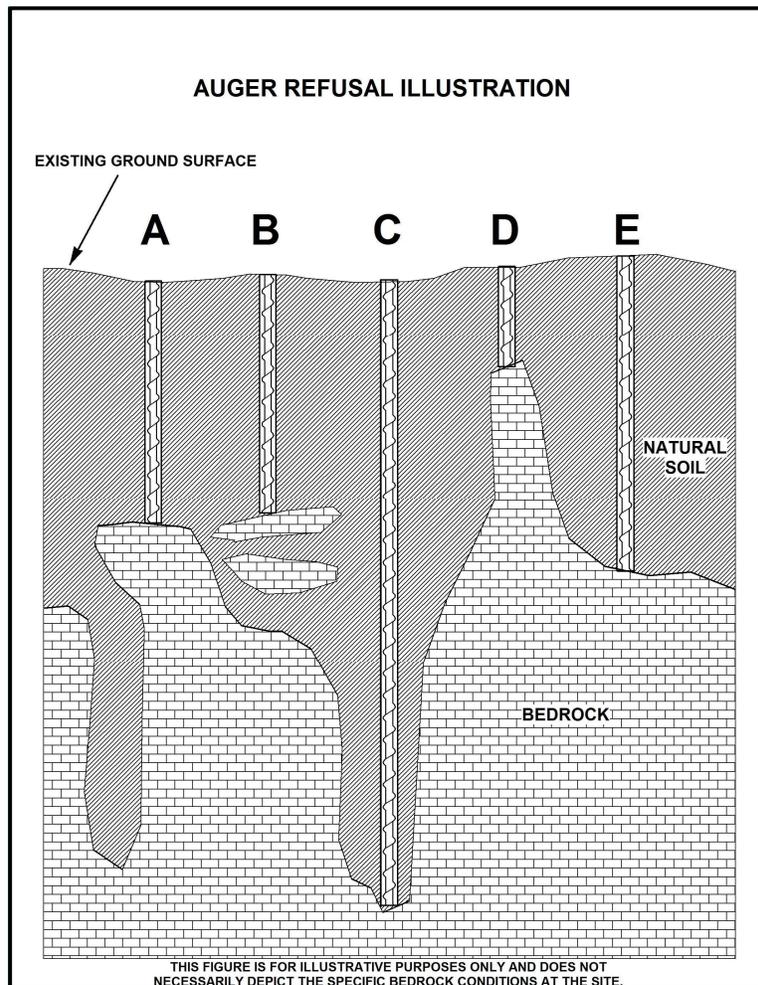
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4	Clayey Sand with Gravel/ Clayey Gravel with Sand	Tan clayey sand with varying amounts of gravel or tan and grey clayey gravel with sand
5	Fat Clay	Red and grey fat clay with varying amounts of sand and gravel

Auger refusal is defined as the depth below the ground surface at which a boring can no longer be advanced with the soil drilling technique being used. Auger refusal is subjective and is based upon the type of drilling equipment used, the types of augers used, and the effort exerted by the driller. Auger refusal can occur on the upper surface of discontinuous bedrock (A), slabs of unweathered rock suspended in the residual soil matrix or "floaters" (B), in widened joints that may extend well below the surrounding bedrock surface (C), on rock "pinnacles" (D) rising above the surrounding bedrock surface, or on the upper surface of continuous bedrock (E). These possible auger refusal conditions are illustrated in the figure below. Linear interpolation of apparent bedrock elevations based upon the boring data is often used but can misrepresent actual rock removal quantities where anomalies exist, such as pinnacled rock, where rock could be shallower than that encountered in the borings. Additional borings, auger probes, test pits, or geophysical testing could be performed to obtain more specific bedrock information.



Groundwater Conditions

The boreholes were observed while drilling and after completion for the presence and level of groundwater. The water levels observed in the boreholes are shown on the boring logs in [Exploration Results](#), and are summarized below.

Boring Number	Approximate Depth to Groundwater while Drilling (feet) ¹	Approximate Depth to Groundwater after Drilling (feet) ¹
B-1	15	15
B-4	15½	15½
B-6	23½	23½

¹. Below ground surface

Groundwater was not observed in the remaining borings or test pits while drilling, or for the short duration the borings were left open prior to backfilling. However, this does not necessarily mean the borings terminated above groundwater, or the water levels summarized above are stable groundwater levels. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for a groundwater level to develop and stabilize in a borehole. Long-term observations in piezometers or observation wells, sealed from the influence of surface water, are often required to define groundwater levels in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. Therefore, groundwater levels during construction or at other times in the life of the structure may be different than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

GEOTECHNICAL OVERVIEW

General

We recommend that the exposed subgrade be thoroughly evaluated after stripping of any topsoil and at the base of all cut areas, and prior to the start of any fill operations. We recommend that the geotechnical engineer be retained to evaluate the bearing material for the foundations and subgrade soils. Subsurface conditions, as identified by the field and laboratory testing programs, have been reviewed and evaluated with respect to the proposed project plans known to us at this time.

Karst development is a common occurrence in this area due to the dissolution of the native limestone bedrock material. Though no evidence of sinkholes was noted in the review of topography and in the borings performed at the subject site, the development of karst features on the site is a possibility over time. The current state of the practice in geotechnical engineering does not allow for the accurate prediction of when or where sinkholes or karst-related subsidence could occur. The owner is advised that construction on this property or essentially any other site within this area, carries with it some risk that future sinkholes may develop.

Possible Karst Development

The subject site is located within karst prone bedrock material. Karst development in this area occurs from the dissolution of the native limestone bedrock material. Over time, groundwater can transport the surrounding soil into bedrock voids causing visible surface features such as circular depressions or areas of drainage. However, some sinkholes may not be readily visible from the surface because they are plugged or capped with a thin layer of rock. Maintaining and managing

adequate storm water drainage is important within karst prone areas, as described in the **Grading and Drainage** section. The image below, provided by MDNR, depicts the development of sinkholes over time.

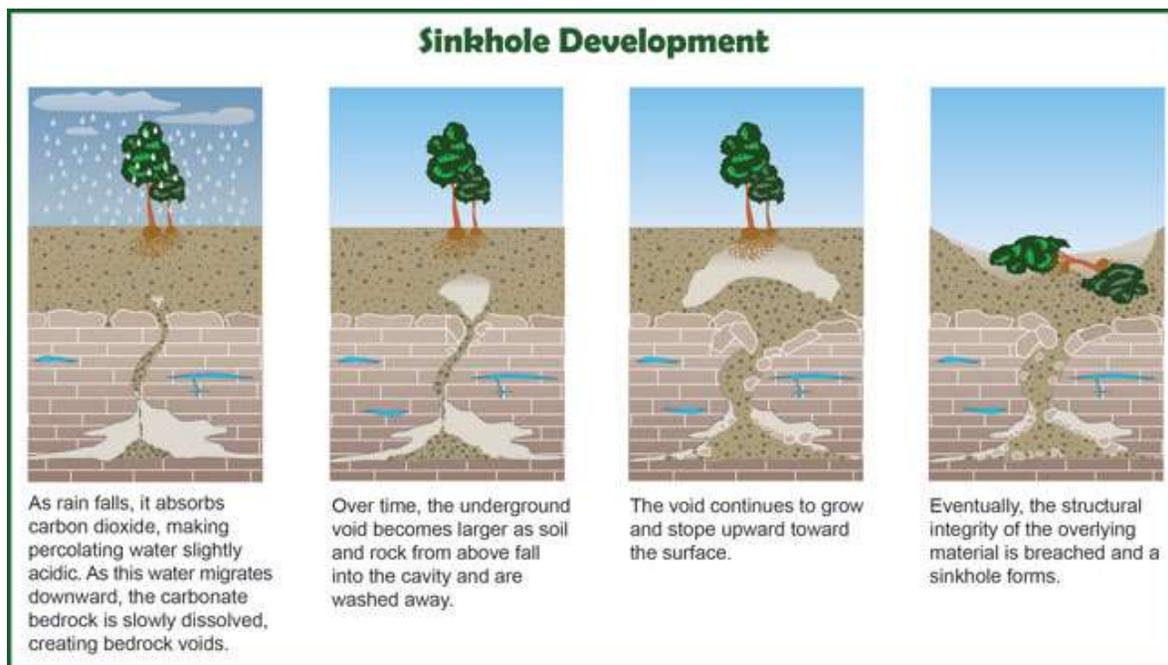


Image courtesy of MDNR

Additional testing of the subgrade including additional borings, bedrock profiling, and subsurface resistivity testing can aid in the detection of sinkholes and karst development. However, this additional testing can be costly and does not guarantee that existing or developing sinkholes will be identified.

Existing Undocumented Fill

Existing fill was encountered to depths of approximately 3 to 5 feet in all borings, and 2½ to 4 feet in all test pits. The fill could extend deeper in areas not explored. While the N-values obtained in the undocumented fill materials were generally equal to or higher than the existing native soils, no documentation or records regarding the placement of this fill were provided for our review. If records of the fill are available, Terracon should be supplied with these documents to better assess the suitability of the existing fill.

Due to the clayey gravels and sands at the subject site, differentiating between native materials and man placed fill in soil boring samples is difficult and in some cases impossible without documentation. The designation of possible fill has been given to materials that are suspected of being fill but no definite indications of fill were noted in the sampling process. These materials should be carefully observed and inspected during excavations for indications of fill by a

representative of Terracon. If indications of fill are found during the excavations, then the material should be treated as fill and the recommendations noted below should be considered.

Undocumented fill may contain soft or loose soil or other unsuitable materials; these conditions may not be disclosed by the widely-spaced, relatively small-diameter borings and test-pits. If these conditions are present and are not discovered and addressed during construction, then larger than normal settlement resulting in cracking, differential movement, or other damage could occur in foundations, floor slabs, pavements, and utility lines supported on or above the existing fill. Typically, larger than normal settlement of floor slabs results in reflective cracking of overlying rigid floor coverings (if any), unlevel floors, and “bumps” at locations of differential movement.

Foundations and floor slabs for the new structure should not bear on or above the undocumented fill materials. The existing fill could be removed and replaced so that the foundations and floor slabs for the new building bear on suitable native soils or on properly placed and compacted engineered fill extending to suitable native soils. The fill should be removed within the proposed building footprint and extend at least 5 feet outside the building perimeter.

Provided the owner is willing to accept the risks associated with supporting pavements over the existing fill materials in exchange for reduced construction costs, portions of the existing undocumented fill could be left in place. To reduce the risk of adverse performance from higher settlement and to provide more consistent support for pavements, some portion of the existing fill should be removed and the exposed existing fill materials should be observed and tested during construction. Where unsuitable conditions are observed, the materials could/should be improved by scarification and recompaction or be removed and replaced with engineered fill. At least 12 inches of new engineered fill should be placed directly below the pavement sections with this option. However, even with the recommended subgrade preparation and construction testing, there is a risk to the owner that unsuitable material within or buried by the fill will not be discovered. If the owner is not willing to accept the risks of supporting pavements over existing undocumented fill materials, the existing fill should be completely removed and replaced.

Portions of the existing fill may be suitable for removal and reuse as an engineered fill material. If this material is used as an engineered fill material, it should be first evaluated by the materials testing firm to determine if it meets the requirements listed in **Material Requirements**. If the material will be used as fill it should be placed as described in **Compaction Requirements**.

Swell Potential

The subject soils within the influence of building foundations and floor slabs generally consists of lean clays with low swell potential, however, high plastic clays were noted at depth in field explorations. These high plastic clay areas may be shallower in areas not explored or exposed in excavations/cuts. These materials are prone to volume change with changes in moisture which

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may lead to excessive shrinking and swelling of floor slabs and lightly-loaded structures. We recommend a low volume change (LVC) zone be constructed beneath the at-grade floor slab. Using an LVC zone as recommended in this report may not eliminate all future subgrade volume change and resultant floor slab movements. However, the procedures outlined herein should help to reduce the potential for subgrade volume change. Existing soils can be left in place and compacted if they are tested during construction and meet LVC material requirements. Details regarding this LVC zone are provided in the **Floor Slab** section.

This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some movement and cracking in the structure could occur. The severity of cracking and other (cosmetic) damage such as uneven floor slabs will likely increase if any modification of the site results in excessive wetting or drying of the expansive soils. Eliminating the risk of movement and distress may not be feasible, but it may be possible to further reduce the risk of movement if more extensive measures are used during construction. We would be pleased to discuss other construction alternatives with you upon request.

All grades must provide effective drainage away from the structure during and after construction. Water permitted to pond next to the structure can result in greater soil movements than those discussed in this report. These greater movements can result in unacceptable differential floor slab movements, cracked slabs and walls, and roof leaks. The recommendations made in this this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained.

Soft Subgrade Potential

The subgrade soils may become unstable when disturbed. During periods of dry weather, these soils may be stable upon initial exposure, however, these soils could become relatively soft and unstable under construction traffic. Further, depending upon site conditions during construction, overexcavation or stabilization of the subgrade and/or base of overexcavations may be needed to achieve a suitable working surface. Accordingly, we recommend that the owner budget for the possibility that overexcavation and/or subgrade stabilization may be required and contractors be prepared to handle potentially unstable and/or soft conditions.

EARTHWORK

Earthwork is anticipated to include clearing and grubbing, excavations, and fill placement.

Site Preparation

Prior to placing fill, existing vegetation and root mat should be removed. Complete stripping of the topsoil should be performed in the proposed building and parking/driveway areas.

The subgrade should be proofrolled with an adequately loaded vehicle such as a fully-loaded, tandem-axle dump truck. The proofrolling should be observed by the Geotechnical Engineer. Areas excessively deflecting under the proofroll should be delineated and subsequently addressed by the Geotechnical Engineer. Such areas should either be removed or modified by following the recommendations in the **Subgrade Stabilization** section. Excessively wet or dry material should either be removed, or moisture conditioned and recompacted.

Subgrade Stabilization

Methods of subgrade improvement, as described below, could include scarification, moisture conditioning and recompaction, and removal of unstable materials and replacement with granular fill (with or without geosynthetics) and chemical stabilization. The appropriate method of improvement, if required, would be dependent on factors such as schedule, weather, the size of the area to be stabilized, and the nature of the instability. More detailed recommendations can be provided during construction as the need for subgrade stabilization occurs. Performing site grading operations during warm seasons and dry periods would help to reduce the amount of subgrade stabilization required.

If the exposed subgrade is unstable during proofrolling operations, it could be stabilized using one of the methods outlined below.

- **Scarification and Compaction** – It may be feasible to scarify, dry, and compact the exposed soils. The success of this procedure would depend primarily upon favorable weather and sufficient time to dry the soils. Stable subgrades likely would not be achievable if the thickness of the unstable soil is greater than about 1 foot, if the unstable soil is at or near groundwater levels, or if construction is performed during a period of wet or cool weather when drying is difficult.
- **Crushed Stone** – The use of crushed stone or gravel is the most common procedure to improve subgrade stability. Typical undercut depths would be expected to range from about 6 to 30 inches below finished subgrade elevation with this procedure. The use of high modulus geosynthetics (i.e., geotextile or geogrid) could also be considered after underground work such as utility construction is completed. Prior to placing the geotextile or geogrid, we recommend that all below-grade construction, such as utility line installation, be completed to avoid damaging the geosynthetic. Equipment should not be operated above the geosynthetic until one full lift of crushed stone fill is placed above it. The maximum particle size of granular

material placed over the geotextile or geogrid should meet the manufacturer’s specifications, and generally should not exceed 1½ inches.

- **Chemical Stabilization** – Improvement of subgrades with Portland cement, lime, lime kiln dust (Code L), or Class C fly ash could be considered for improving unstable soils. Chemical modification should be performed by a prequalified contractor having experience with successfully stabilizing subgrades in the project area on similar sized projects with similar soil conditions. Results of chemical analysis of the additive materials should be provided to the geotechnical engineer prior to use. The hazards of chemicals blowing across the site or onto adjacent property should also be considered. Additional testing would be needed to develop specific recommendations to improve subgrade stability by blending chemicals with the site soils. Additional testing could include, but not be limited to, evaluating various admixtures, the optimum amounts required, the presence of sulfates in the soil, and freeze-thaw durability of the subgrade.

Further evaluation of the need and recommendations for subgrade stabilization can be provided during construction as the geotechnical conditions are exposed.

Fill Material Types

Materials used for fill should meet the following material property requirements:

Fill Type ¹	USCS Classification	Acceptable Location for Placement
High Plasticity Material	CH (LL≥70 or PI≥40)	3 feet below base of floors and other lightly-loaded structures; 2 feet below foundations; and 1 foot below base of pavements
Moderate to High Plasticity Material ²	CH or CL, with 70>LL≥45 or 40>PI≥25	2 feet below base of floor slabs and any other lightly-loaded structures, 1 foot below base of pavements
Granular Material ³	GM, GC, SM, or SC	All locations and elevations
Low Plasticity Material ⁴	CL (LL<45 & PI<25) or Granular Material ³	

1. Compacted structural fill should consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to Terracon for evaluation. On-site soils generally appear suitable for use as fill, subject to the “acceptable location for placement” limitations described in this table.
2. Delineation of moderate to high plasticity clays should be performed in the field by a representative of the Geotechnical Engineer, and could require additional laboratory testing. If fat clay material contains greater than 35 percent granular material retained on a ¾-inch sieve, it may be used in the low volume change zone.
3. Crushed limestone aggregate, or granular material such as sand, gravel or crushed stone containing at least 15 percent low plasticity fines.

-
4. Low plasticity cohesive soil or granular soil having low plasticity fines. Material should be approved by the geotechnical engineer.
-

Fill Compaction Requirements

Fill should meet the following compaction requirements.

Item	Description
Fill Lift Thickness¹	9 inches or less in loose thickness
Compaction Requirements²	At least 95 percent of the material's maximum standard Proctor dry density ³
Water Content Range	Low plasticity cohesive: -2 percent to +2 percent of optimum ³ High plasticity cohesive: 0 to +4 percent of optimum ³ Granular: Workable moisture levels ⁴

-
1. Reduced lift thicknesses of 4 to 6 inches are recommended in confined areas (e.g., utility trenches, foundation excavations, and foundation backfill) and when hand-operated compaction equipment is used.
 2. We recommend that engineered fill be tested for moisture content and compaction during placement. If the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved. As stated within ASTM D 698, this procedure is intended for soils with 30 percent or less material larger than ¾ inch. Accordingly, we recommend full time proofroll observation be performed instead of moisture density testing for materials containing more than 30 percent aggregate retained on the ¾-inch sieve.
 3. As determined by the standard Proctor test (ASTM D 698).
 4. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.
-

Utility Trench Backfill

For low permeability subgrades, utility trenches are a common source of water infiltration and migration. Utility trenches penetrating beneath the building should be effectively sealed to restrict water intrusion and flow through the trenches, which could migrate below the building. The trench should provide an effective trench plug that extends at least 5 feet from the face of the building exterior. The plug material should consist of cementitious flowable fill or low permeability lean clay. The trench plug material should be placed to surround the utility line. If used, the lean clay trench plug material should be placed and compacted to comply with the water content and compaction recommendations for structural fill stated previously in this report.

Grading and Drainage

All grades must provide effective drainage away from the building during and after construction and should be maintained throughout the life of the structure. Water retained next to the building can result in soil movements greater than those discussed in this report. Greater movements can

result in unacceptable differential floor slab and/or foundation movements, cracked slabs and walls, and roof leaks. The roof should have gutters/drains with downspouts that discharge onto splash blocks at a distance of at least 10 feet from the building.

Exposed ground should be sloped and maintained at a minimum 5 percent away from the building for at least 10 feet beyond the perimeter of the building. Locally, flatter grades may be necessary to transition ADA access requirements for flatwork. After building construction and landscaping have been completed, final grades should be verified to document effective drainage has been achieved. Grades around the structure should also be periodically inspected and adjusted, as necessary, as part of the structure's maintenance program. Where paving or flatwork abuts the structure, a maintenance program should be established to effectively seal and maintain joints and prevent surface water infiltration.

Earthwork Construction Considerations

Shallow excavations for the proposed structure are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade becomes excessively wet or dry, frozen, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to further construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety, or the contractor's activities; such responsibility shall neither be implied nor inferred.

Construction Observation and Testing

The earthwork efforts should be observed and tested by a representative of the Geotechnical Engineer. Observation and testing should include documentation of removal of vegetation and topsoil, proofrolling, and mitigation of areas delineated by the proofroll to require mitigation.

In areas of foundation excavations, the bearing subgrade should be evaluated by the Geotechnical Engineer. If unacceptable conditions are encountered, the Geotechnical Engineer should be contacted to recommend mitigation options.

SHALLOW FOUNDATIONS

Provided the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for design of shallow foundations.

Design Parameters – Compressive Loads

Item	Description
Maximum Net Allowable Bearing pressure ^{1, 2, 3}	2,000 psf (foundation bearing on undisturbed soils or engineered fill) ⁷ Note Exception Below
Minimum Foundation Dimensions	Columns: 30 inches Continuous: 18 inches
Ultimate Passive Resistance ⁴ (equivalent fluid pressures)	250 pcf (cohesive backfill) 350 pcf (granular backfill)
Ultimate Coefficient of Sliding Friction ⁵	0.32 (native clay) 0.40 (granular material)
Minimum Embedment below Finished Grade	30 inches on soil
Estimated Total Settlement from Structural Loads ²	Less than about 1 inch
Estimated Differential Settlement ^{2, 6}	About ¾ of total settlement

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied. Values assume that exterior grades are no steeper than 20 percent within 10 feet of the structure.
2. Values provided are for the maximum loads noted in **Project Description**.
3. Unsuitable or soft soils, including undocumented fill, should be overexcavated and replaced per the recommendations presented in **Earthwork**.
4. Use of passive earth pressures require the sides of the excavation for the spread footing foundation to be nearly vertical and the concrete placed neat against these vertical faces or that the footing forms be removed and compacted structural fill be placed against the vertical footing face.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. Should be neglected if passive pressure will be used to resist lateral loads.
6. Differential settlements are as measured over a span of up to 50 feet.
7. Soft soils were encountered in the area of boring B-2. Test pits evaluated in the area appeared to be firm during excavation. If soft soils are encountered during field observations, additional recommendations will be required. To reduce the potential risk of overexcavation of soft soils in this area during foundation construction, aggregate piers may be considered to improve bearing pressure and reduce settlement. Recommendations for aggregate piers are included below.

Construction Adjacent to Existing Building

Differential settlement between the additions and the existing building is expected to approach the magnitude of the total settlement of the addition. Expansion joints should be provided between

the existing building and the proposed addition to accommodate differential movements between the two structures. Underground piping between the two structures should be designed with flexible couplings and utility knockouts in foundation walls should be oversized, so minor deflections in alignment do not result in breakage or distress. Care should be taken during excavation adjacent to existing foundations, to avoid disturbing existing foundation bearing soils.

New footings should bear at or near the bearing elevation of immediately adjacent existing foundations. Depending upon their locations and current loads on the existing footings, footings for the new addition could cause settlement of adjacent walls. To reduce this concern and risk, clear distances at least equal to the new footing widths should be maintained between the addition's footings and footings supporting the existing building.

We understand existing foundations may support additional load from the walls of the new additions. Based on our understanding of the **Project Description**, the additional loads should be limited to about 2-4 klf. It is possible additional loads on the existing foundations could cause other building settlements to occur. The structural capacity of existing foundations should be evaluated by a licensed structural engineer, where increases in loading are planned.

Ground Improvement Utilizing Aggregate Piers/Stone Columns

Considering the soft soils in the area of B-2 and proximity of new foundations to the existing building, soil modifications utilizing rammed/vibratory aggregate piers/columns may be a cost-effective alternative to support shallow foundation loads at this site. The use of this type of soil modification can also increase the allowable bearing capacity of the existing soil. The piers can often be designed for a specified bearing capacity. Maximum obtainable bearing capacities are also site specific and may vary between 3,000 psf to 8,000 psf.

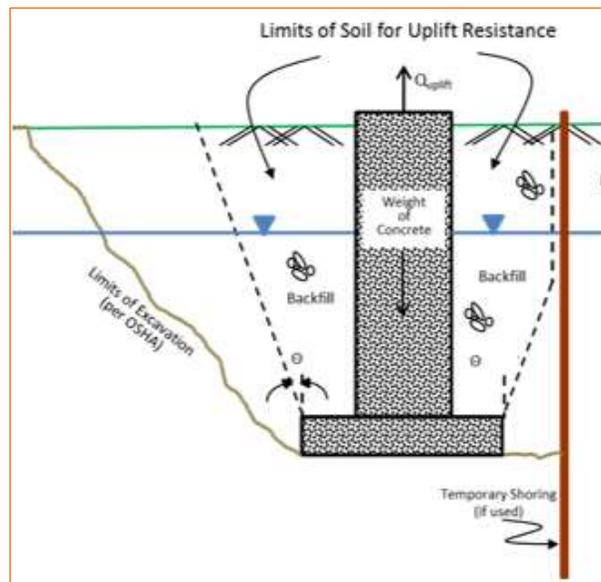
There are two main systems of this type of soil modification, one using a ramming action to compact the soil and one utilizing a vibrating system. These systems typically consist of 18- to 24-inch diameter drilled holes that are filled in lifts of well-graded aggregate that is densified by either ramming or vibration to form very stiff, high-density aggregate piers/columns. The compacted aggregate piers/columns produce high lateral stresses within the surrounding soil matrix, thereby stiffening the reinforced composite soil/aggregate mass. This results in significant strengthening and stiffening of the foundation bearing layer to support footings within the required settlement tolerances.

Aggregate pier foundation elements are usually part of the foundation contractor's design-build system. Therefore, the subsurface exploration information contained in this report should be provided to the foundation contractors for detailed analysis and design and cost information. The foundation contractor selected for doing the installation should be contact prior to the start of excavations, as these elements are often installed from the existing ground surface. The client should be prepared with a desired targeted bearing capacity to discuss with the foundation

contractor. The allowable net bearing capacity following installation of aggregate piers will be provided by the designer.

Design Parameters - Uplift Loads

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils. As illustrated on the subsequent figure, the effective weight of the soil prism defined by diagonal planes extending up from the top of the perimeter of the foundation to the ground surface at an angle, θ , of 20 degrees from the vertical can be included in uplift resistance. The maximum allowable uplift capacity should be taken as a sum of the effective weight of soil plus the dead weight of the foundation, divided by an appropriate factor of safety. A maximum total unit weight of 100 pcf should be used for the backfill. This unit weight should be reduced to 40 pcf for portions of the backfill or natural soils below the groundwater elevation.



Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be observed and tested by a representative Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed. Placement of a lean concrete mudmat over the bearing soils should be considered if the excavations must remain open for an extended period of time.

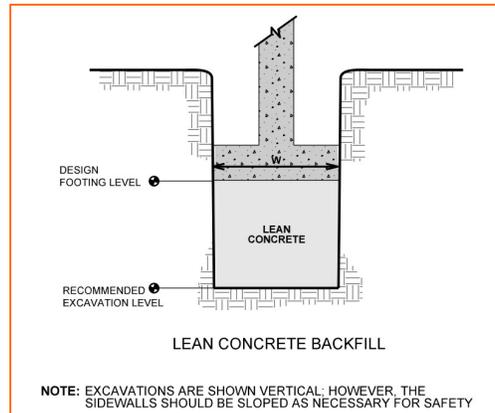
If unsuitable bearing soils are encountered at the base of the planned footing excavation, the excavation should be extended deeper to suitable soils, and the footings could bear directly on

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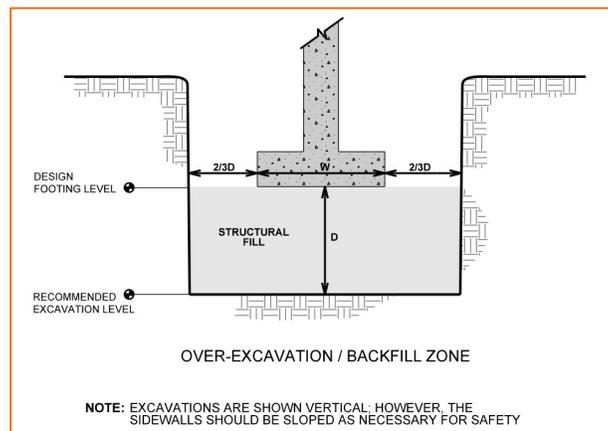
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these soils at the lower level or on lean concrete backfill placed in the excavations. This is illustrated on the sketch below.



Over-excavation for structural fill placement below footings should be conducted as shown below. The over-excavation should be backfilled up to the footing base elevation with suitable fill materials, as recommended in the **Earthwork** section.



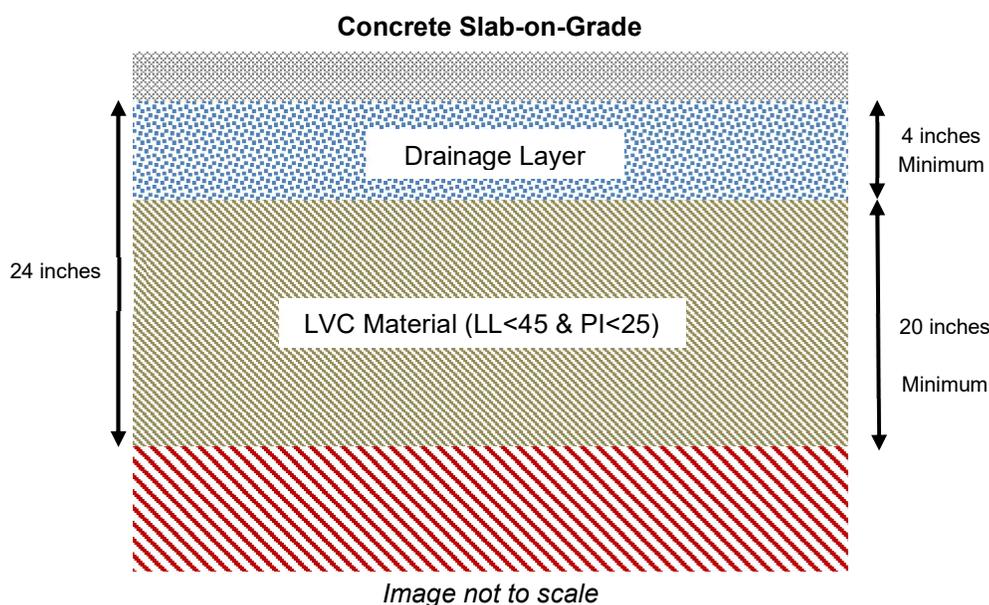
SEISMIC CONSIDERATIONS

The seismic design requirements for buildings and other structures are based on Seismic Design Category. The Site Class is required to determine the Seismic Design Category for a structure. The Site Class is based on the upper 100 feet of the site profile defined by a weighted average value of either shear wave velocity, standard penetration resistance, or undrained shear strength in accordance with Section 20.4 of ASCE 7 and the International Building Code (IBC). Based on the subsurface conditions encountered at the site and as described on the exploration logs and results, it is our professional opinion that the **Seismic Site Class is C**. Subsurface explorations at this site were extended to a maximum depth of 31½ feet. The site properties below the boring

depth to 100 feet were estimated based on our experience and knowledge of geologic conditions of the general area. We could perform additional deeper borings or geophysical testing to confirm the conditions below the current boring depths.

FLOOR SLABS

If undocumented fill is encountered, the undocumented fill should be removed and replaced or measures taken, as previously discussed if the owner is willing to accept the risks associated with construction of floor slabs over existing fill. Grade-supported floor slabs should be supported on a minimum of 24 inches of LVC material. LVC fill should be placed and compacted as recommended in section **Earthwork**.



Floor Slab Design Parameters

Item	Description
Floor slab support ^{1, 2}	A minimum 24-inch thick low volume change (LVC) layer over suitable native soil or engineered fill
Modulus of subgrade reaction	150 pounds per square inch per inch (psi/in) for point loading conditions
Granular course beneath slab ^{3, 4, 5}	Minimum 4 inches
Capillary break layer thickness ^{4, 5}	Minimum 4 inches

Item	Description
1.	We recommend an LVC layer be present below the floor slab. This layer should be at least 24 inches thick and should meet the LVC material criteria outlined in this report in section Earthwork . Where existing soils meet the LVC criteria, they should be moisture conditioned and recompact as recommended in this report.
2.	We recommend subgrades be maintained in a relatively moist condition until the floor slab is constructed. If the subgrade should become excessively wet or dry prior to construction of the floor slab, the affected material should be removed or the materials be scarified, moisture conditioned, and recompact. Upon completion of grading operations in the building area, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slab.
3.	If the purpose of this layer is solely to create a level base for concrete placement to maintain a more uniform slab thickness, well-graded sand, gravel or crushed stone can be used.
4.	If penetration of moisture vapor through the slab is a concern, in our opinion the floor slab design should include a capillary break layer in addition to a vapor retarder (refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of vapor retarders). In our opinion, capillary break layers should be comprised of granular materials that have less than 5 percent fines (material passing the #200 sieve). Other design considerations such as cold temperatures and condensation development could warrant additional design considerations.
5.	These granular materials may be considered part of the LVC zone.

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut contraction joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to ACI 360, Guide to Design of Slabs-on-Ground. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy-duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing or other means.

Settlement of floor slabs supported on existing fill materials cannot be accurately predicted, but could be larger than normal and result in some cracking. Mitigation measures, as noted in **Existing Fill** within **Earthwork**, are critical to the performance of floor slabs. In addition to the mitigation measures, the floor slab can be stiffened by adding steel reinforcement, grade beams and/or post-tensioned elements.

Floor Slab Construction Considerations

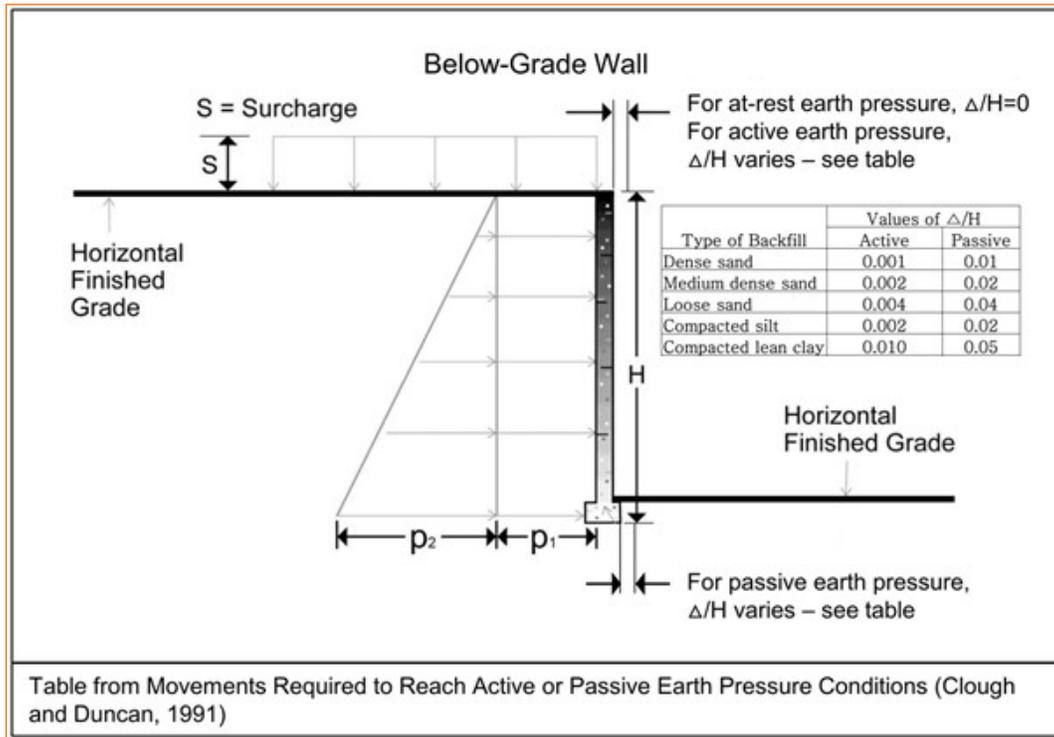
Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become excessively wet or dry or damaged prior to construction of floor slabs, the affected material should be removed and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should approve the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

LATERAL EARTH PRESSURES

Design Parameters

Structures with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to values indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown in the diagram below. Active earth pressure is commonly used for design of free-standing cantilever retaining walls and assumes wall movement. The "at-rest" condition assumes no wall movement and is commonly used for basement walls, loading dock walls, or other walls restrained at the top. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls (unless stated).



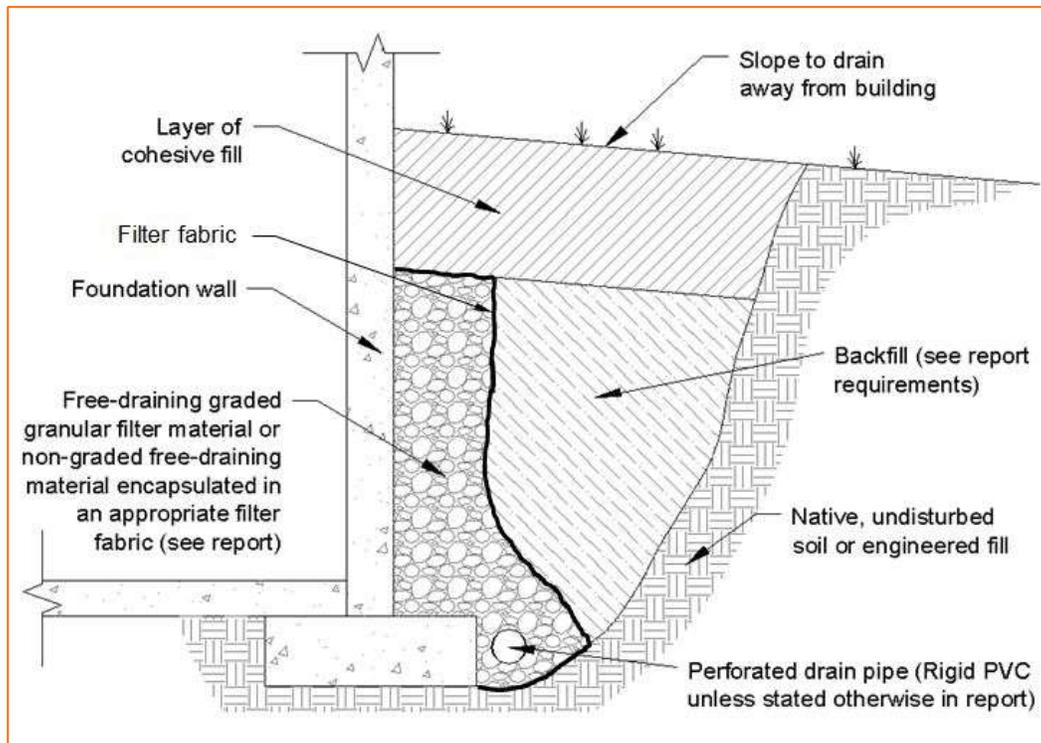
Lateral Earth Pressure Design Parameters				
Earth Pressure Condition ¹	Coefficient for Backfill Type ²	Surcharge Pressure ^{3, 4, 5} p_1 (psf)	Effective Fluid Pressures (psf) ^{2, 4, 5}	
			Unsaturated ⁶	Submerged ⁶
Active (K_a)	Granular - 0.31	(0.31)S	(40)H	(80)H
	Fine Grained - 0.41	(0.41)S	(50)H	(85)H
At-Rest (K_o)	Granular - 0.47	0.47)S	(55)H	(90)H
	Fine Grained - 0.58	(0.58)S	(70)H	(95)H
Passive (K_p)	Granular - 3.25	---	(390)H	(250)H
	Fine Grained - 2.46	---	(295)H	(205)H

1. For active earth pressure, wall must rotate about base, with top lateral movements 0.002 H to 0.004 H, where H is wall height. For passive earth pressure, wall must move horizontally to mobilize resistance.
2. Uniform, horizontal backfill, compacted to at least 95% of the ASTM D 698 maximum dry density, rendering a maximum unit weight of 120 pcf.
3. Uniform surcharge, where S is surcharge pressure.
4. Loading from heavy compaction equipment is not included.
5. No safety factor is included in these values.
6. To achieve "Unsaturated" conditions, follow guidelines in **Subsurface Drainage for Below-Grade Walls** below. "Submerged" conditions are recommended when drainage behind walls is not incorporated into the design.

Backfill placed against structures should consist of granular soils or low plasticity cohesive soils. For the granular values to be valid, the granular backfill must extend out and up from the base of the wall at an angle of at least 45 and 60 degrees from vertical for the active and passive cases, respectively.

Subsurface Drainage for Below-Grade Walls

A perforated rigid plastic drain line installed behind the base of walls and extends below adjacent grade is recommended to prevent hydrostatic loading on the walls. The invert of a drain line around a below-grade building area or exterior retaining wall should be placed near foundation bearing level. The drain line should be sloped to provide positive gravity drainage to daylight or to a sump pit and pump. The drain line should be surrounded by clean, free-draining granular material having less than 5% passing the No. 200 sieve. The free-draining aggregate should be encapsulated in a filter fabric. The granular fill should extend to within 2 feet of final grade, where it should be capped with compacted cohesive fill to reduce infiltration of surface water into the drain system.



As an alternative to free-draining granular fill, a pre-fabricated drainage structure may be used. A pre-fabricated drainage structure is a plastic drainage core or mesh which is covered with filter fabric to prevent soil intrusion, and is fastened to the wall prior to placing backfill.

PAVEMENTS

General Pavement Comments

Pavements are typically more tolerant of nonuniform subgrade conditions than foundations and floor slabs. As discussed in the **Geotechnical Overview** section, portions of existing undocumented fill may remain in the pavement areas if the owner is willing to accept the potential for higher than normal settlement, distress, and/or maintenance in exchange for reduced construction costs. A minimum of 1 foot of the existing fill below the pavement base rock should be replaced with newly compacted structural fill consisting of LVC material. If the owner is not willing to accept the risks of supporting pavements over existing undocumented fill materials, the existing fill should be completely removed and replaced to support pavements.

Support characteristics of subgrades for pavement design do not account for shrink/swell movements of an expansive clay subgrade, such as the soils encountered on this site. Thus, the pavement may be adequate from a structural standpoint, yet still experience cracking and deformation due to shrink/swell related movement of the subgrade. To reduce the potential for settlement/heave and associated cracking of the pavement, we recommend that at least the upper 12 inches of subgrade beneath the pavement base rock consist of LVC material.

Pavement Subgrade Preparation

On most project sites, the grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturate some areas, heavy traffic from concrete trucks and other delivery vehicles disturb the subgrade and many surface irregularities are filled in with loose soils to improve stability temporarily. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

We recommend the moisture content and density of the upper 9 inches of the subgrade be evaluated and the pavement subgrades be proofrolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the material with compacted structural fill.

After proofrolling and repairing deep subgrade deficiencies, the entire subgrade should be scarified and developed as recommended in section **Earthwork** to provide a more consistent subgrade for pavement construction. Areas that appear desiccated (dry) following site stripping may require further undercutting and moisture conditioning. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed

by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

Pavement Design Parameters

Traffic loading was not provided; however, we estimated the new parking areas will be primarily used by cars and pick-up trucks (i.e., standard-duty). A limited number of delivery trucks, refuse disposal vehicles, and tractor trailers (i.e., heavy-duty) are expected in the drive lanes and loading areas (estimated maximum of 5 trucks per week). Heavy-duty pavement should be utilized for anticipated areas of heavy traffic, loading/unloading zones, fire lanes, dumpster pad areas, and any areas of frequent maneuvering of heavy vehicles. If additional traffic or loading is anticipated, Terracon should be consulted to revisit and possibly revise the pavement section recommended thicknesses.

Pavement design methods are intended to provide structural sections with adequate thickness over a particular subgrade such that wheel loads are reduced to a level the subgrade can support. Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to pavements should slope down from pavement edges at a minimum 2 percent;
- The subgrade and the pavement surface should have a minimum 2 percent slope to promote proper surface drainage;
- Drainage should be provided for the pavement base course;
- Joint sealant should be installed and cracks sealed immediately;
- Compacted, low permeability backfill should be placed against the exterior side of curbs and gutters, and all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils; and,
- To reduce the likelihood of water seeping beneath curbs into the pavement base course; curb, gutter and/or sidewalks should bear directly on clay subgrade soils rather than on unbound granular base course materials.

Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

Asphaltic Concrete Design		
Layer	Thickness (inches)	
	Standard-Duty ¹	Heavy-Duty ¹
Asphalt Thickness	Asphalt Surface: 3	Asphalt Surface: 2 Asphalt Base: 3
Aggregate Base ²	6	6

1. See **Pavement Design Parameters** section above for more specifics regarding Standard-Duty and Heavy-Duty traffic.
2. Crushed stone (MoDOT Type 5 aggregate)

Portland Cement Concrete Design		
Layer	Thickness (inches)	
	Standard-Duty ¹	Heavy-Duty ¹
Portland Cement Concrete ²	5	6
Aggregate base ³	4	4

1. See **Pavement Design Parameters** section above for more specifics regarding Standard-Duty and Heavy-Duty traffic.
2. 4,000 psi at 28 days, 4-inch maximum slump and 5 to 7 percent air entrained. PCC pavements are recommended for trash container pads and in any other areas subjected to heavy wheel loads and/or turning traffic.
3. Crushed stone (MoDOT Type 5 aggregate)

Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrades should be graded to provide positive drainage within the granular base section. We recommend the subgrades beneath the pavement sections be graded to slope toward the storm water catch basins. A drainage collection and removal system (e.g., finger drains) could be used to allow water in the granular base to enter the storm sewers, or otherwise be removed from the granular base.

Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a pavement maintenance program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required. Geosynthetic reinforcement between the subgrade and base rock could be considered to increase the time before maintenance is required.

GENERAL COMMENTS

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Natural variations may occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Support of pavements over existing fill is discussed in this report. However, even with the recommended construction testing, there is a risk that unsuitable materials within or buried by the fill will not be discovered. This risk cannot be eliminated without removing the fill but can be reduced by thorough exploration and testing.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence or collaboration through this system are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client, and is not intended for

Geotechnical Engineering Report

Cassville High School Performing Arts Center ■ Cassville, Missouri

January 6, 2023 ■ Terracon Project No. B5225065



third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation costs. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation costs. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety, cost estimating, excavation support, and dewatering requirements/design are the responsibility of others. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

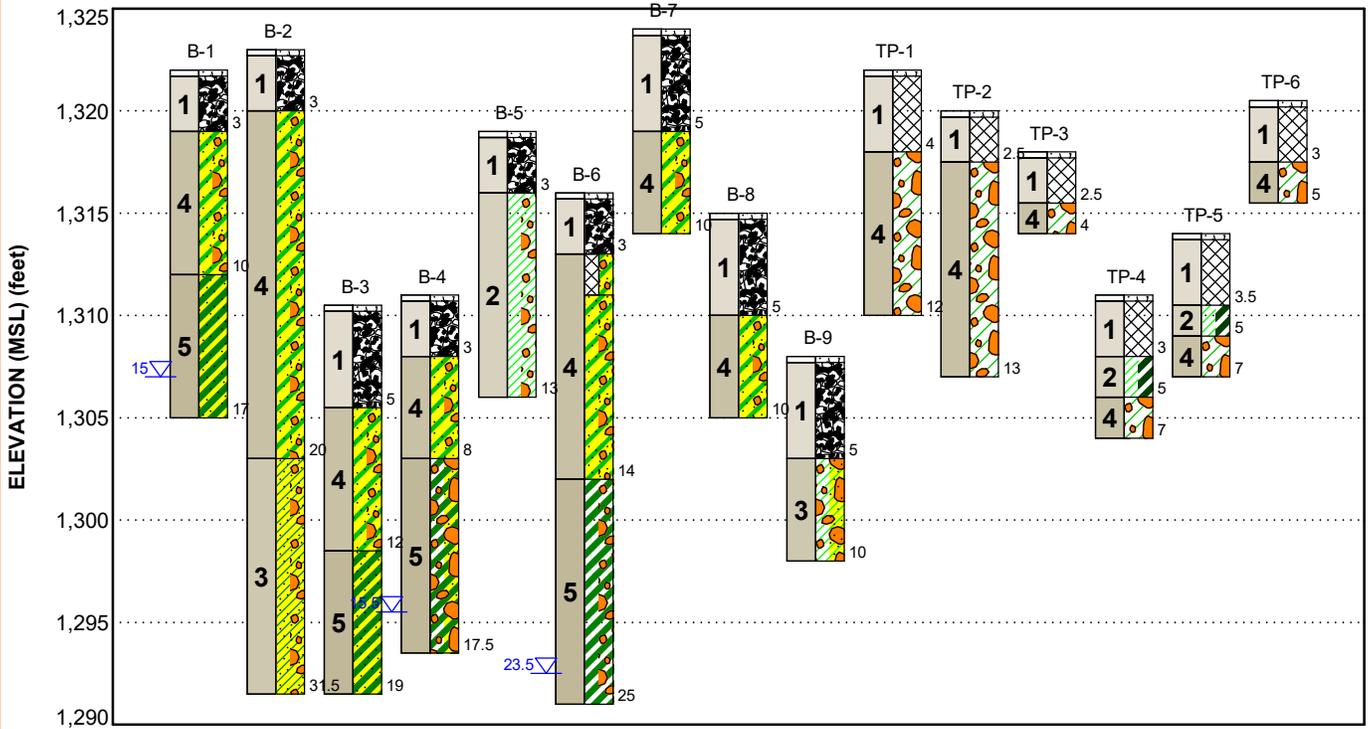
FIGURES

Contents:

GeoModel

GEOMODEL

Cassville Performing Arts Center ■ Cassville, MO
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This is not a cross section. This is intended to display the Geotechnical Model only. See individual logs for more detailed conditions.

Model Layer	Layer Name	General Description
1	Fill Material	Fill material-sandy and/or gravelly lean clay or clayey sand with gravel
2	Lean Clay	Brown lean clay with trace amounts of sand and gravel
3	Sandy/Gravelly Lean Clay	Sandy or gravelly lean clay
4	Clayey Sand with Gravel/ Clayey Gravel with Sand	Tan clayey sand with varying amounts of gravel or tan and grey clayey gravel with sand
5	Fat Clay	Red and grey fat clay with varying amounts of sand and gravel

LEGEND

- Topsoil
- Sandy Fat Clay
- Lean Clay with Gravel
- Fill
- Fill
- Sandy Lean Clay with Gravel
- Fat Clay with Gravel
- Clayey Gravel
- Clayey Sand with Gravel
- Gravelly Fat Clay with Sand
- Gravelly Lean Clay with Sand
- Lean Clay/Fat Clay

First Water Observation

NOTES:

Layering shown on this figure has been developed by the geotechnical engineer for purposes of modeling the subsurface conditions as required for the subsequent geotechnical engineering for this project. Numbers adjacent to soil column indicate depth below ground surface.

Groundwater levels are temporal. The levels shown are representative of the date and time of our exploration. Significant changes are possible over time. Water levels shown are as measured during and/or after drilling. In some cases, boring advancement methods mask the presence/absence of groundwater. See individual logs for details.

ATTACHMENTS

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Number of Borings	Boring Depth (feet) ¹	Planned Location
6	25 or auger refusal	Planned building area
3	10 or auger refusal	Planned parking/driveway area

1. Below ground surface
2. Borings 1, 3, 4, and 5 encountered auger refusal on a possible cobble, boulder, or bedrock prior to their planned termination depth. Boring 2 was extended beyond the planned boring depth due to soft native soils (N<4) within the zone of influence. All other borings extended to their planned depths.

Boring Layout and Elevations: The boring layout was performed by Terracon. Coordinates were obtained by interpolation from Google Earth Pro. Approximate elevations were obtained by interpolation from a topographic map provided by the client. If more precise boring locations and elevations are desired, we recommend the borings be surveyed.

Subsurface Exploration Procedures: The borings were advanced with a track-mounted rotary drill rig using continuous flight, solid-stem augers. Samples were obtained in the borings as noted in **Exploration Results**. The thin-walled tube sampling was performed with a thin-walled, seamless steel tube with a sharp cutting edge that was pushed hydraulically into the soil to obtain a relatively undisturbed sample. The split-barrel sampling procedure was performed using a standard 2-inch outer diameter, split-barrel sampling spoon that was driven into the ground by a 140-pound automatic hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration was recorded as the Standard Penetration Test (SPT) resistance value. The SPT resistance values, also referred to as N-values, are indicated on the boring logs at their respective test depths. Water levels were observed and recorded during drilling and sampling. For safety purposes, all borings were backfilled with auger cuttings after their completion. The test pits were performed with an excavator to determine approximate undocumented fill depths and extent of soft subgrades in the vicinity of boring B-2. Test pits were backfilled with the excavated material upon completion.

The sampling depths, penetration distances, and other sampling information were recorded on the field boring logs. The samples were placed in appropriate containers and taken to our soil laboratory for testing and classification by a Geotechnical Engineer. Our exploration team prepared field boring logs as part of the drilling operations. These field logs included visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

Geotechnical Engineering Report

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Laboratory Testing

Classification of the soil samples was performed in general accordance with the Unified Soil Classification System (USCS) based on the material's texture and plasticity. The project engineer reviewed the field data and assigned laboratory tests to better understand the engineering properties of the various soil strata.

- Water (Moisture) Content of Soil and Rock by Mass
- Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- Particle-Size Analysis of Soils

SITE LOCATION AND EXPLORATION PLANS

Contents:

Site Location Plan
Boring Location Plan
Exploration Plan
Geologic Map

SITE LOCATION

Cassville High School Performing Arts Center ■ Cassville, Missouri
January 6, 2023 ■ Terracon Project No. B5225065

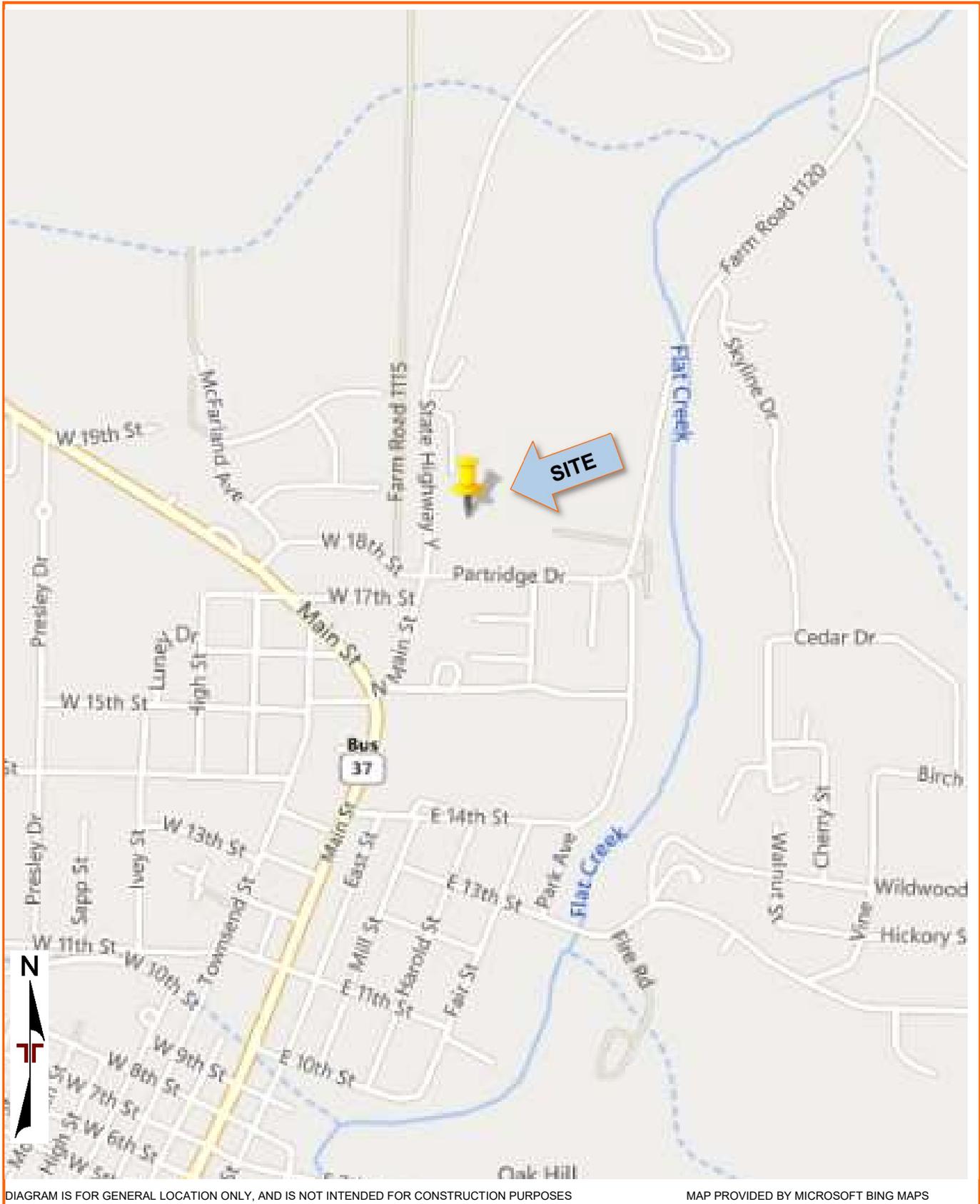


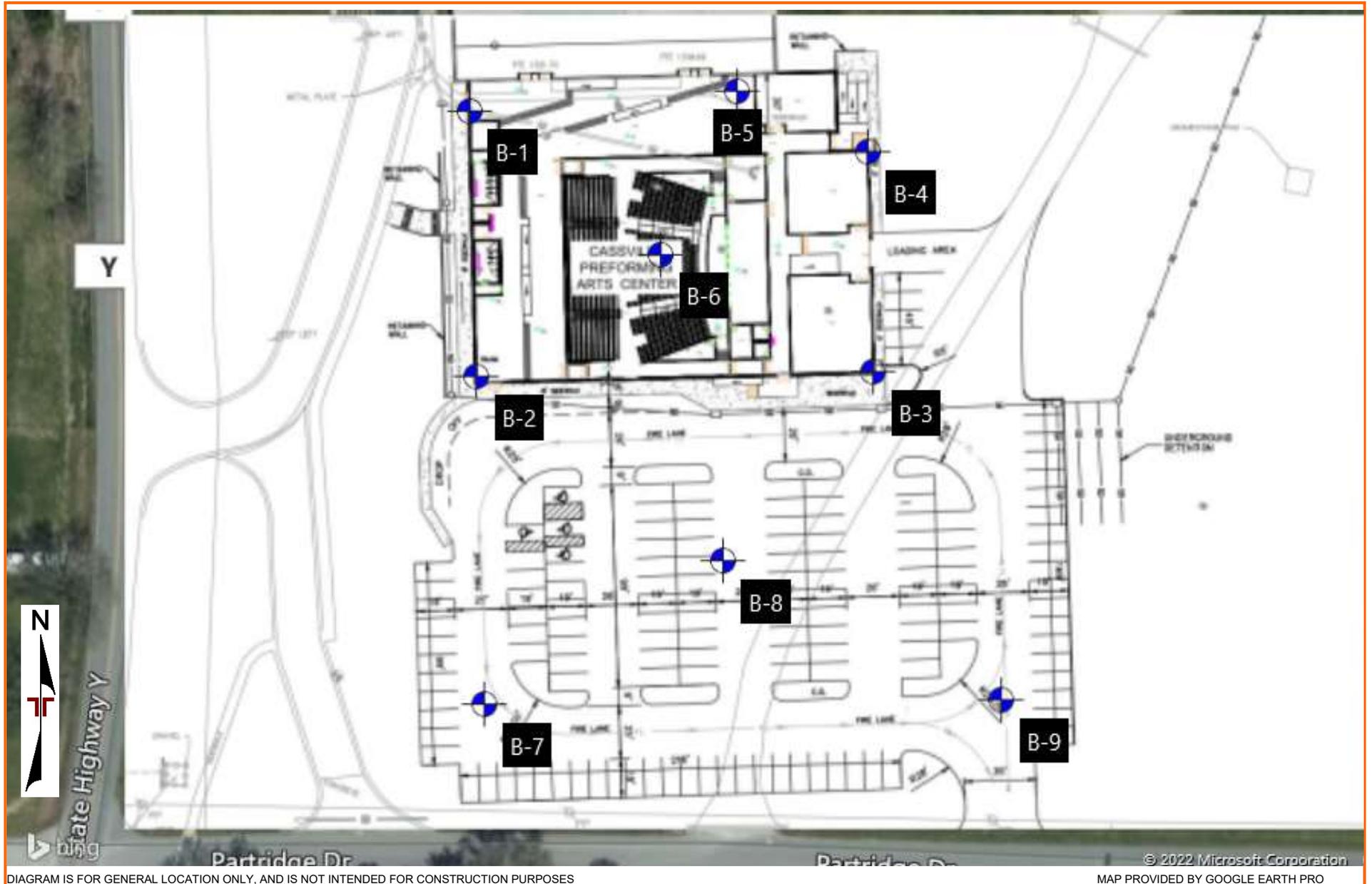
DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

BORING LOCATION PLAN

Cassville High School Performing Arts Center ■ Cassville, Missouri

January 6, 2023 ■ Terracon Project No. B5225065



EXPLORATION PLAN

Cassville High School Performing Arts Center ■ Cassville, Missouri

January 6, 2023 ■ Terracon Project No. B5225065

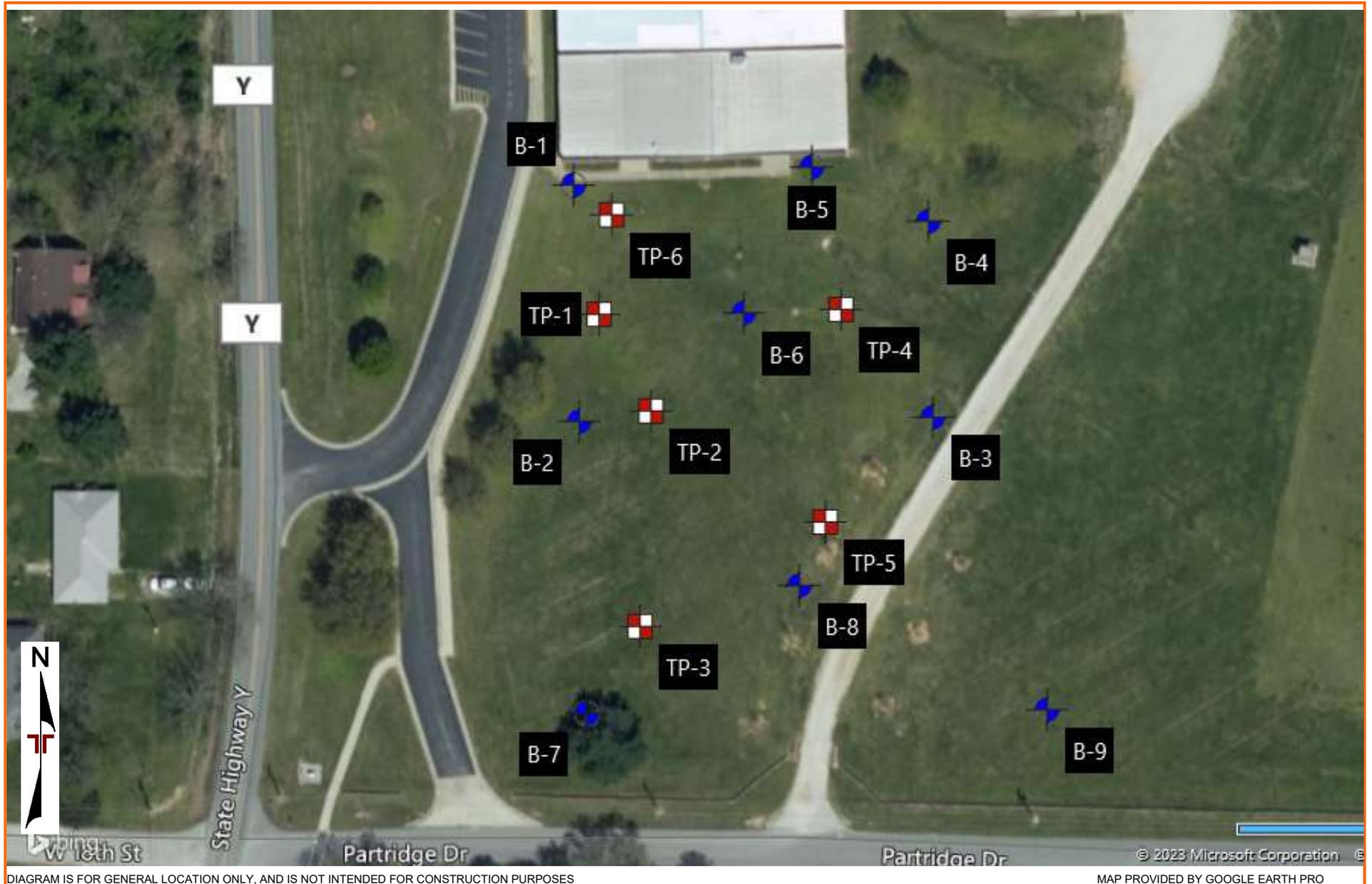


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY GOOGLE EARTH PRO

GEOLOGIC MAP

Cassville High School Performing Arts Center ■ Cassville, Missouri

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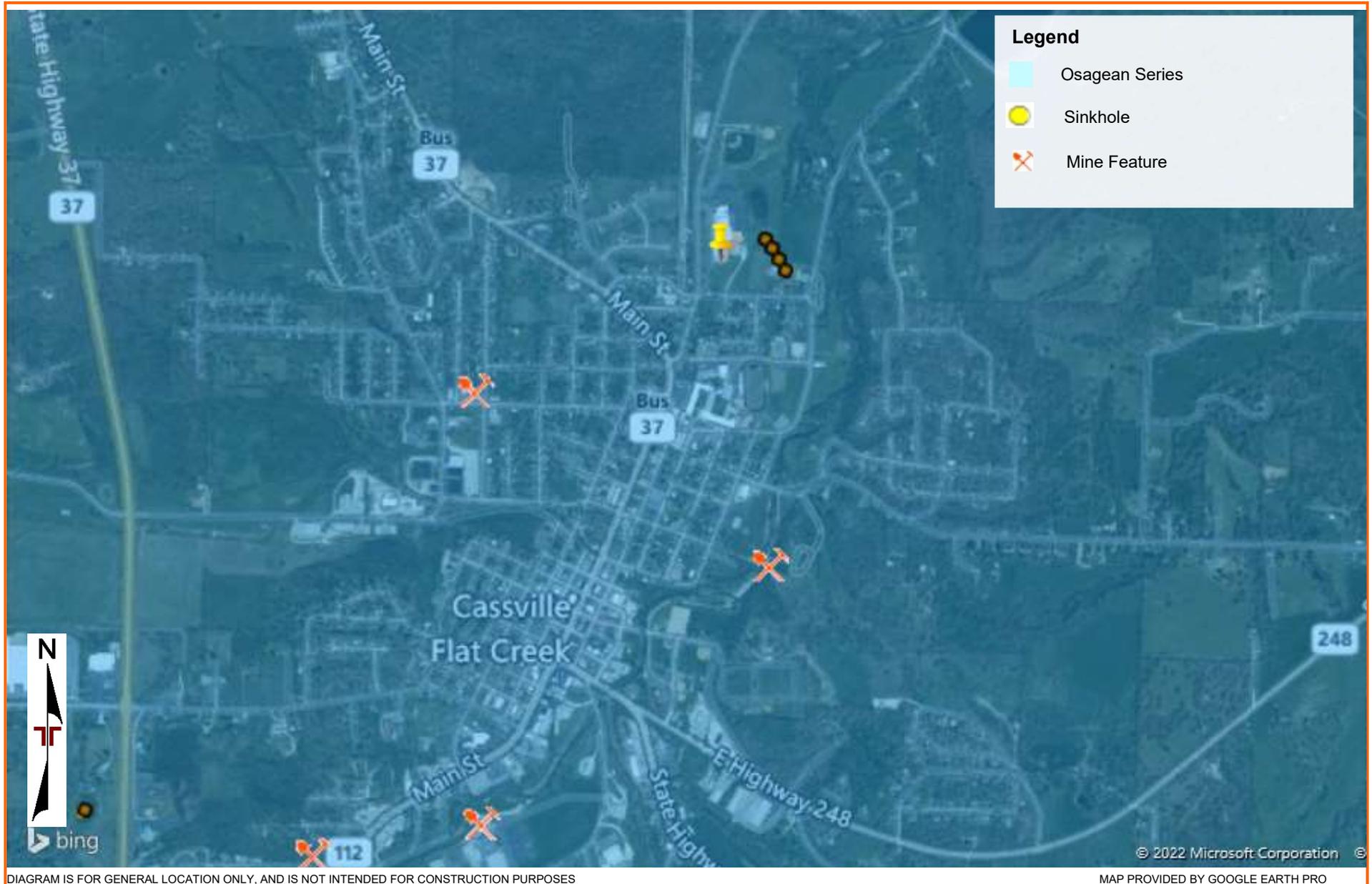


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY GOOGLE EARTH PRO

EXPLORATION RESULTS

Contents:

Boring Logs

Atterberg Limits

Grain Size Distribution

BORING LOG NO. B-1

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6895° Longitude: -93.8630°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS
										LL-PL-PI
		Surface Elev.: 1322 (Ft.) ELEVATION (Ft.)								
		0.3 TOPSOIL (3")	1321.7							
1		FILL - CLAYEY SAND WITH GRAVEL (SC) , grey	1319		X	9	13-50	N/A	11.5	
		3.0 CLAYEY SAND WITH GRAVEL (SC) , brown red, medium dense to dense	1319		X	11	27-50	N/A	7.3	
4					X	8	7-7-11 N=18	N/A	14.6	
		10.0 SANDY FAT CLAY WITH GRAVEL (CH) , red, soft	1312		X	9	12-7-4 N=11	N/A	9.4	
5					X	3	1-1-1 N=2	0.5 (HP)	23.6	
		17.0 Auger Refusal at 17 Feet	1305		▽					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" C.F.A.

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Auger refusal on possible cobbles, boulder, or bedrock.

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

▽ While drilling



Boring Started: 12-02-2022

Boring Completed: 12-02-2022

Drill Rig: #546

Driller: DH

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. B-4

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6894° Longitude: -93.8623°	DEPTH	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS
												LL-PL-PI
			0.3	1310.7								
1		TOPSOIL (3")										
		FILL - SANDY LEAN CLAY WITH GRAVEL (CL) , brown										
			3.0	1308					5-4-5 N=9	N/A	15.9	28-19-9
4		CLAYEY SAND WITH GRAVEL (SC) , red and brown, dense			5							
									8-19-20 N=39	N/A	10.9	
									4-22-24 N=46	N/A	9.9	
		GRAVELLY FAT CLAY WITH SAND (CH) , red and grey, stiff to very stiff	8.0	1303	10				12-17-12 N=29	1.0 (HP)	30.2	
5									5-6-5 N=11	1.0 (HP)	29.9	
		Auger Refusal at 17.5 Feet	17.5	1293.5	15							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" C.F.A.

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Auger refusal on possible cobbles, boulder, or bedrock.

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

While drilling

Boring Started: 12-05-2022

Boring Completed: 12-05-2022

Drill Rig: #546

Driller: DH

Project No.: B5225065



THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. B-5

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6893° Longitude: -93.8626° Surface Elev.: 1319 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS
										LL-PL-PI
DEPTH										
		0.3 TOPSOIL (3")	1318.7							
1		FILL - GRAVELLY LEAN CLAY WITH SAND (CL) , brown	1316			13	10-9-6 N=15	1.0 (HP)	18.4	
2		LEAN CLAY WITH GRAVEL AND SAND (CL) , red and grey, stiff to very stiff	1306			14	8-7-7 N=14	1.0 (HP)	17.9	
						16	4-4-6 N=10	1.0 (HP)	20.2	
						16	15-13-8 N=21	1.5 (HP)	15.6	
		Auger Refusal at 13 Feet	1306							

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" C.F.A.

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Auger refusal on possible cobbles, boulder, or bedrock.

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



Boring Started: 12-05-2022

Boring Completed: 12-05-2022

Drill Rig: #546

Driller: DH

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. B-7

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6886° Longitude: -93.8623°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS
										LL-PL-PI
		DEPTH	ELEVATION (Ft.)							
		0.3 TOPSOIL (3")	1323.7							
1		FILL - CLAYEY SAND WITH GRAVEL (SC) , grey								
		5.0	1319							
4		CLAYEY SAND WITH GRAVEL (SC) , brown red, dense to very dense								
		10.0	1314							
		Boring Terminated at 10 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" C.F.A.

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



Boring Started: 12-05-2022

Boring Completed: 12-05-2022

Drill Rig: #546

Driller: DH

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. B-8

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6888° Longitude: -93.8626° Surface Elev.: 1315 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		DEPTH								
		0.3' TOPSOIL (3")	1314.7							
1		FILL - CLAYEY SAND WITH GRAVEL (SC) , grey				13	4-9-21 N=30	0.5 (HP)	19.9	
		5.0'	1310			10		N/A	8.7	
4		CLAYEY SAND WITH GRAVEL (SC) , brown red, medium dense				8	6-10-8 N=18	N/A	7.7	
		10.0'	1305			9	8-10-11 N=21	1.0 (HP)	21.8	
		Boring Terminated at 10 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" C.F.A.

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



Boring Started: 12-02-2022

Boring Completed: 12-02-2022

Drill Rig: #546

Driller: DH

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. B-9

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6887° Longitude: -93.8622°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTEBERG LIMITS
										LL-PL-PI
		DEPTH	ELEVATION (Ft.)							
		0.3 TOPSOIL (3")	1307.7							
1		FILL - LEAN CLAY (SC) , trace sand and gravel, grey				15	2-2-2 N=4	1.0 (HP)	20.5	33-17-16
		5.0	1303			8	5-6-5 N=11	1.5 (HP)	17.2	
3		GRAVELLY LEAN CLAY WITH SAND (CL) , red to grey, very stiff				14	2-6-10 N=16	1.0 (HP)	20.3	
		10.0	1298			15		N/A	13.6	
Boring Terminated at 10 Feet										

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
4" C.F.A.

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Boring backfilled with Auger Cuttings and/or Bentonite

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



Boring Started: 12-05-2022

Boring Completed: 12-05-2022

Drill Rig: #546

Driller: DH

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. TP-1

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6893° Longitude: -93.8630° Surface Elev.: 1322 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		DEPTH								
1		0.3' TOPSOIL	1321.7							
		FILL - LEAN CLAY WITH GRAVEL (CL) , light brown								
4		4.0' CLAYEY GRAVEL (GC) , red and grey	1318							
		Boring Terminated at 12 Feet	1310							

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavator, 3' bucket

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Backfilled with test pit material

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



Boring Started: 01-05-2023

Boring Completed: 01-05-2023

Drill Rig:

Driller:

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. TP-2

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6891° Longitude: -93.8629° Surface Elev.: 1320 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS	
										LL-PL-PI	
		DEPTH									
1		0.3 TOPSOIL	1319.7								
		FILL - LEAN CLAY WITH GRAVEL (CL) , light brown	1317.5								
		2.5 CLAYEY GRAVEL (GC) , red and grey	1307								
4		Boring Terminated at 13 Feet									

Stratification lines are approximate. In-situ, the transition may be gradual.

<p>Advancement Method: Excavator, 3' bucket</p>	<p>See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).</p> <p>See Supporting Information for explanation of symbols and abbreviations.</p> <p>Elevations were interpolated from a topographic site plan.</p>	<p>Notes:</p>						
<p>Abandonment Method: Backfilled with test pit material</p>								
<p>WATER LEVEL OBSERVATIONS <i>Groundwater not encountered</i></p>	 4765 W Junction St Springfield, MO	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Boring Started: 01-05-2023</td> <td style="width: 50%;">Boring Completed: 01-05-2023</td> </tr> <tr> <td>Drill Rig:</td> <td>Driller:</td> </tr> <tr> <td colspan="2">Project No.: B5225065</td> </tr> </table>	Boring Started: 01-05-2023	Boring Completed: 01-05-2023	Drill Rig:	Driller:	Project No.: B5225065	
Boring Started: 01-05-2023	Boring Completed: 01-05-2023							
Drill Rig:	Driller:							
Project No.: B5225065								

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE_PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. TP-3

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6888° Longitude: -93.8629° Surface Elev.: 1318 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY ()	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		DEPTH								
		0.3' TOPSOIL	1317.7							
1		FILL - LEAN CLAY WITH GRAVEL (CL) , light brown	1315.5							
4		CLAYEY GRAVEL (GC) , red and grey	1314							
		Boring Terminated at 4 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavator, 3' bucket

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Backfilled with test pit material

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



4765 W Junction St
Springfield, MO

Boring Started: 01-05-2023

Boring Completed: 01-05-2023

Drill Rig:

Driller:

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE_PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. TP-4

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6893° Longitude: -93.8625° Surface Elev.: 1311 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (')	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		DEPTH								
		0.3 TOPSOIL	1310.7							
1		FILL - LEAN CLAY (CL) , light brown								
		3.0	1308							
2		LEAN TO FAT CLAY (CL/CH) , trace gravel, brown red								
		5.0	1306							
4		CLAYEY GRAVEL (GC) , red and grey								
		7.0	1304							
		Boring Terminated at 7 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
Excavator, 3' bucket

See [Exploration and Testing Procedures](#) for a description of field and laboratory procedures used and additional data (if any).

Notes:

Abandonment Method:
Backfilled with test pit material

See [Supporting Information](#) for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

WATER LEVEL OBSERVATIONS

Groundwater not encountered



Boring Started: 01-05-2023

Boring Completed: 01-05-2023

Drill Rig:

Driller:

Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE_PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. TP-5

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6890° Longitude: -93.8625° Surface Elev.: 1314 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (')	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		DEPTH								
		0.3' TOPSOIL	1313.7							
1		FILL - LEAN CLAY (CL) , light brown								
		3.5'	1310.5							
2		LEAN TO FAT CLAY (CL/CH) , trace gravel, brown red								
		5.0'	1309							
4		CLAYEY GRAVEL (GC) , red and grey								
		7.0'	1307							
		Boring Terminated at 7 Feet								

Stratification lines are approximate. In-situ, the transition may be gradual.

<p>Advancement Method: Excavator, 3' bucket</p>	<p>See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any).</p> <p>See Supporting Information for explanation of symbols and abbreviations.</p> <p>Elevations were interpolated from a topographic site plan.</p>	<p>Notes:</p>						
<p>Abandonment Method: Backfilled with test pit material</p>								
<p>WATER LEVEL OBSERVATIONS <i>Groundwater not encountered</i></p>	<p>4765 W Junction St Springfield, MO</p>	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Boring Started: 01-05-2023</td> <td style="width: 50%;">Boring Completed: 01-05-2023</td> </tr> <tr> <td>Drill Rig:</td> <td>Driller:</td> </tr> <tr> <td colspan="2">Project No.: B5225065</td> </tr> </table>	Boring Started: 01-05-2023	Boring Completed: 01-05-2023	Drill Rig:	Driller:	Project No.: B5225065	
Boring Started: 01-05-2023	Boring Completed: 01-05-2023							
Drill Rig:	Driller:							
Project No.: B5225065								

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE_PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

BORING LOG NO. TP-6

PROJECT: Cassville Performing Arts Center

CLIENT: Paragon Architecture LLC
Springfield, MO

SITE: 1825 State Hwy Y
Cassville, MO

MODEL LAYER	GRAPHIC LOG	LOCATION See Exploration Plan Latitude: 36.6894° Longitude: -93.8629° Surface Elev.: 1320.5 (Ft.) ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	RECOVERY (%)	FIELD TEST RESULTS	LABORATORY HP (tsf)	WATER CONTENT (%)	ATTERBERG LIMITS LL-PL-PI
		0.3' TOPSOIL	1320.2							
1		FILL - LEAN CLAY (CL) , light brown	3.0							
4		CLAYEY GRAVEL (GC) , red and grey	5.0							
Boring Terminated at 5 Feet			5							

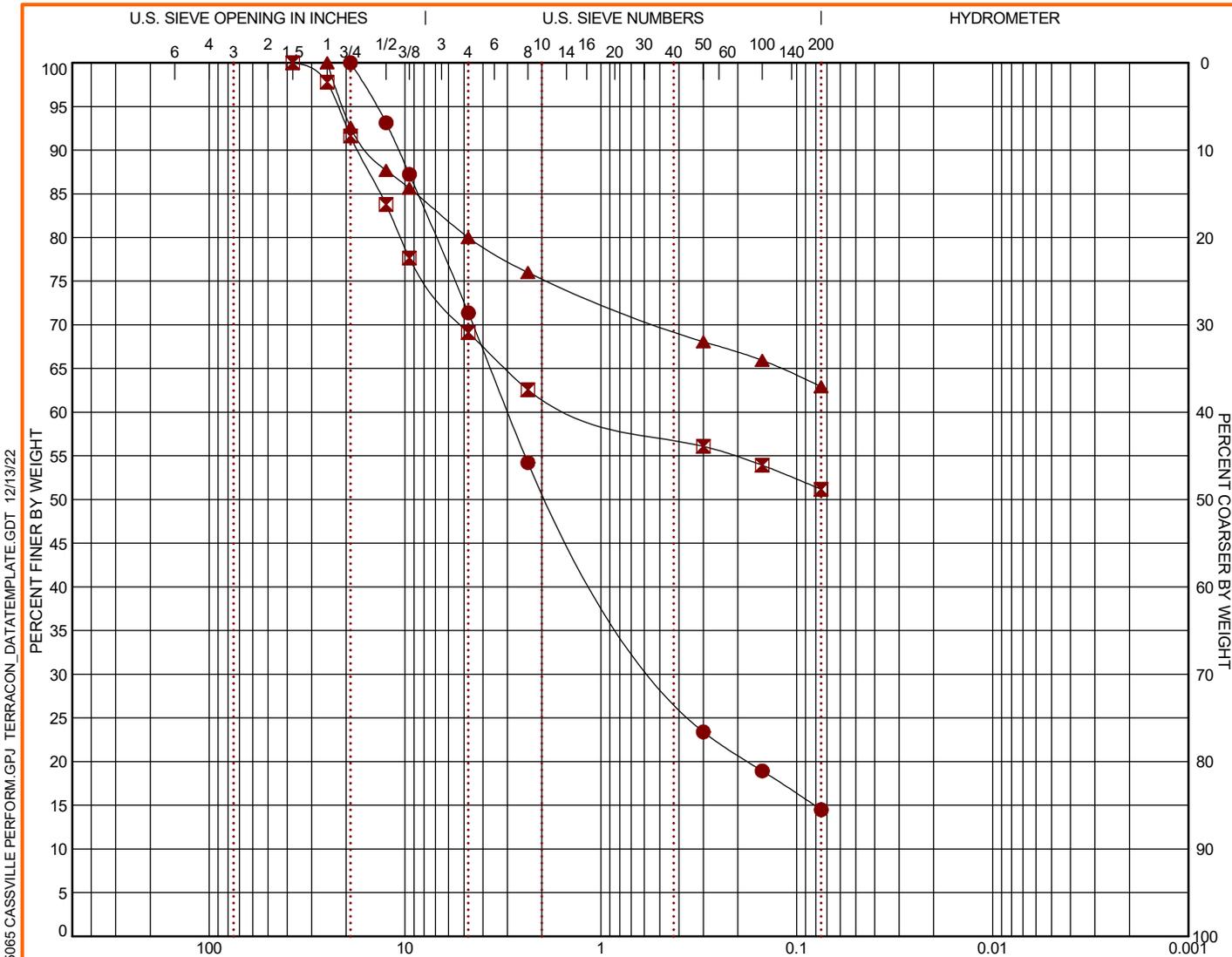
Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method: Excavator, 3' bucket	See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (if any). See Supporting Information for explanation of symbols and abbreviations. Elevations were interpolated from a topographic site plan.	Notes:
Abandonment Method: Backfilled with test pit material		
WATER LEVEL OBSERVATIONS <i>Groundwater not encountered</i>	<p style="font-size: 0.8em; margin: 0;">4765 W Junction St Springfield, MO</p>	Boring Started: 01-05-2023 Boring Completed: 01-05-2023 Drill Rig: Driller: Project No.: B5225065

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL_B5225065_CASSVILLE_PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 1/6/23

GRAIN SIZE DISTRIBUTION

ASTM D422 / ASTM C136



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BORING ID	DEPTH	% COBBLES	% GRAVEL	% SAND	% SILT	% FINES	% CLAY	USCS
● B-1	3.5 - 4.5	0.0	28.6	56.9		14.5		
☒ B-2	1 - 2.5	0.0	30.9	17.9		51.2		
▲ B-5	6 - 7.5	0.0	20.0	17.1		62.9		

GRAIN SIZE			
	●	☒	▲
D ₆₀	2.987	1.042	
D ₃₀	0.467		
D ₁₀			

COEFFICIENTS			
	●	☒	▲
C _c			
C _u			

	●	☒	▲
Sieve	% Finer	Sieve	% Finer
3/4"	100.0	1 1/2"	100.0
1/2"	93.13	1"	97.78
3/8"	87.23	3/4"	91.63
#4	71.37	1/2"	83.76
#100	54.23	3/8"	77.65
#200	23.4	#4	69.1
	18.93	#100	62.57
	14.49	#200	56.09
			53.92
			51.17

SOIL DESCRIPTION	
●	Clayey Sand with Gravel
☒	Gravelly Clay with Sand
▲	Clay with Sand and Gravel

REMARKS	
●	
☒	
▲	

LABORATORY TESTS ARE NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GRAIN SIZE: USCS 1 B5225065 CASSVILLE PERFORM.GPJ TERRACON_DATATEMPLATE.GDT 12/13/22

PROJECT: Cassville Performing Arts Center

SITE: 1825 State Hwy Y
Cassville, MO



4765 W Junction St
Springfield, MO

PROJECT NUMBER: B5225065

CLIENT: Paragon Architecture LLC
Springfield, MO

SUPPORTING INFORMATION

Contents:

General Notes

Unified Soil Classification System

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification		
				Group Symbol	Group Name ^B	
Coarse-Grained Soils: More than 50% retained on No. 200 sieve	Gravels: More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels: Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3$ ^E	GW	Well-graded gravel ^F	
			$Cu < 4$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	GP	Poorly graded gravel ^F	
		Gravels with Fines: More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F, G, H}	
			Fines classify as CL or CH	GC	Clayey gravel ^{F, G, H}	
	Sands: 50% or more of coarse fraction passes No. 4 sieve	Clean Sands: Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3$ ^E	SW	Well-graded sand ^I	
			$Cu < 6$ and/or $[Cc < 1 \text{ or } Cc > 3.0]$ ^E	SP	Poorly graded sand ^I	
		Sands with Fines: More than 12% fines ^D	Fines classify as ML or MH	SM	Silty sand ^{G, H, I}	
			Fines classify as CL or CH	SC	Clayey sand ^{G, H, I}	
Fine-Grained Soils: 50% or more passes the No. 200 sieve	Silts and Clays: Liquid limit less than 50	Inorganic:	$PI > 7$ and plots on or above "A"	CL	Lean clay ^{K, L, M}	
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay ^{K, L, M, N}
			Liquid limit - not dried			Organic silt ^{K, L, M, O}
	Silts and Clays: Liquid limit 50 or more	Inorganic:	PI plots on or above "A" line	CH	Fat clay ^{K, L, M}	
			PI plots below "A" line	MH	Elastic Silt ^{K, L, M}	
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay ^{K, L, M, P}
			Liquid limit - not dried			Organic silt ^{K, L, M, Q}
	Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

^A Based on the material passing the 3-inch (75-mm) sieve.

^B If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

^C Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

^D Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.

^E $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

^F If soil contains $\geq 15\%$ sand, add "with sand" to group name.

^G If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

^H If fines are organic, add "with organic fines" to group name.

^I If soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^J If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

^K If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

^L If soil contains $\geq 30\%$ plus No. 200 predominantly sand, add "sandy" to group name.

^M If soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.

^N $PI \geq 4$ and plots on or above "A" line.

^O $PI < 4$ or plots below "A" line.

^P PI plots on or above "A" line.

^Q PI plots below "A" line.

