CLACKAMAS
WATER ENVIRONMENT SERVICES

GREGORY L. GEIST | DIRECTOR

Water Quality Protection
Surface Water Management
Wastewater Collection & Treatment

January 19, 2023 BCC Agenda Date/Item: _____

Board of County Commissioners
Acting as the governing body of Water Environment Services
Clackamas County

Approval of a Construction Contract (7262) with McClure and Sons, Inc., for the Tri-City Water Resource Recovery Facility Primary Clarifier Rehabilitation Project. Total value is $5,424,730.00 through 04/05/2026. Funding through WES' Sanitary Sewer Construction Fund. No County General Funds are involved.

Previous Board Action/Review	Prior discussions related to budget and Capital Improvements Plan and briefed at Issues January 17, 2023.		
Performance Clackamas	1. This project supports the County's Strategic Plan of building a strong infrastructure that delivers services to customers and honors, utilizes, promotes and invests in our natural resources.		
Counsel Review	Yes	**Procurement Review**	Yes
Contact Person	Jeff Stallard	**Contact Phone**	503-742-4694

EXECUTIVE SUMMARY: WES has completed engineering design and bidding of the Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation Project. Primary treatment at the Tri-City WRRF is provided by six rectangular primary clarifiers that remove surface scum and suspended solids prior to secondary treatment. Each concrete basin is equipped with flow control gates, chain and flight sludge collection mechanisms, and helical scum skimmers and troughs. The Primary Clarifier Condition Assessment performed in 2017 determined that a number of assets at the primary clarifiers were in poor or very poor condition, requiring priority rehabilitation, including the concrete basins, gates, sludge collectors, and scum skimmers.

The bid price is for the first phase of the project, which will rehabilitate Primary Basins No. 1 and 2. The scope of work includes rehabilitation of corroded concrete, full mechanism replacement, and miscellaneous mechanical and electrical improvements to the Primary Building situated on top of a portion of the basins. This work will occur during the dry weather season in 2023. Alternative bid pricing has also been secured for rehabilitation of Basins No. 3 through 6, and may be awarded via a future contract amendment pending successful completion of the work on the first two basins. Should the alternatives be awarded, work on Basins No. 3 and 4 is anticipated in 2024 with Basins No. 5 and 6 to follow in 2025.

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RECOMMENDATION: Staff recommends that the Board of County Commissioners of Clackamas County, acting as the governing body of Water Environment Services, approve and execute the Contract between Water Environment Services and McClure and Sons, Inc. for the Tri-City Water Resource Recovery Facility Primary Clarifier Rehabilitation Project.

Respectfully submitted,

Greg Geist
Director, WES

Attachment: Contract 7262

WATER ENVIRONMENT SERVICES
AGREEMENT BETWEEN OWNER AND CONTRACTOR
FOR CONSTRUCTION

CONTRACT# 7262

This Agreement is entered into by and between Water Environment Services ("Owner"), an intergovernmental entity formed pursuant to Oregon Revised Statutes Chapter 190, and **McClure and Sons, Inc.** ("Contractor"). This Agreement will be effective on the last date of signature by the parties below, which is the Effective Date of the Contract.

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions, both identified more specifically in Article 7 below. All references to General Conditions implicitly include a reference to any modifications made by the Supplementary Conditions to the same paragraph.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Improvements to six existing rectangular primary clarifier basins at the Tri-City Water Resource Recovery Facility (WRRF), including structural concrete repair; demolition and replacement of existing clarifier mechanisms; ventilation improvements; bypass pumping; improvements to the architectural, electrical and mechanical systems in the primary clarifier building; associated modifications to the control system; and miscellaneous other improvements to the existing facility as shown. Base Contract: Primary Clarifier's 1 & 2 Bid Alternate 1 (If Accepted): Primary Clarifier's 3 & 4 Bid Alternate 2 (If Accepted): Primary Clarifier's 5 & 6

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

ARTICLE 3—ENGINEER

3.01 The Owner will provide an Engineer to act as Owner's representative, assume all duties and responsibilities of Engineer, and have the rights and authority assigned to Engineer in the Contract.

3.02 The part of the Project that pertains to the Work has been designed by Jacobs Engineering Group, Inc.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence*

A. All time limits for Milestones, if any, Substantial Completion, and final completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.03 *Contract Times: Days*

A. The Work will be substantially complete within 1142 days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 1172 days after the date when the Contract Times commence to run.

4.04 *Milestones*

A. Parts of the Work must be substantially completed on or before the following Milestone(s):

1. Major Equipment Submittal Milestone: Submit Rectangular Sedimentation Basin Mechanism submittal within 30 days of the date that the Contract Times commence to run.

2. Milestone 1: Parts of the Work that occur in 2023 requiring primary clarifiers to be out of service must be substantially complete by September 30, 2023. All primary clarifier basins must be returned to normal service prior to October 1, 2023 and remain in service through May 31, 2024.

3. Milestone 2: Subject to the award of Bid Alternate 1 as defined in the Bid Form, parts of the Work that occur in 2024 requiring primary clarifiers to be out of service must be substantially complete by September 30, 2024. All primary clarifier basins must be returned to normal service prior to October 1, 2024 and remain in service through May 31, 2025.

4. Milestone 3: Subject to the award of Bid Alternate 2 as defined in the Bid Form, parts of the Work that occur in 2025 requiring primary clarifiers to be out of service must be substantially complete by September 30, 2025. All primary clarifier basins must be returned to normal service prior to October 1, 2025 and remain in service thereafter.

4.05 *Liquidated Damages*

A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):

1. *Substantial Completion:* Contractor shall pay Owner $1,700 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.

2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall pay Owner $1,700 for each day that expires after such time until the Work is completed and ready for final payment.

3. *Milestones:* Contractor shall pay Owner $1,700 for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of each Milestone, until each Milestone is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.

4. Liquidated damages for failing to timely attain Milestones, Substantial Completion, and final completion are not additive, and will not be imposed concurrently.

4.06 *National Pollutant Discharge Elimination System Permit Violations*

A. Tri-City WRRF must continuously be in compliance with its National Pollutant Discharge Elimination System (NPDES) permit requirements. In the event permit violations are caused or, in the Owner's opinion, will be caused by the Contractor's operations, the Owner shall immediately be entitled to employ others to stop the violations without giving written notice to the Contractor.

B. Penalties imposed on and costs incurred by the Owner as a result of any NPDES permit violations caused by the actions of the Contractor, his employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to the Owner resulting directly or indirectly from the violation.

C. The Owner may withhold from any payments owed to the Contractor the amount of such costs, and a Change Order shall be issued to reflect any such reduction.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

A. Total of Lump Sum Amount, Unit Price Work (subject to final Unit Price adjustment), and Major Equipment Schedule $**5,424,730.00**.

B. For all Work, at the prices stated in Contractor's Bid, attached hereto as Exhibit A.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

A. Owner shall make progress payments on the basis of Contractor's Applications for Payment on or about 30 days following receipt of an Application for Payment during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.

1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.

a. Ninety-five (95) percent of the value of the Work completed (with the balance being retainage). Retainage will be held in an interest-bearing escrow account. Interest on the retainage amount accrues from the date the payment request is approved until the date the retainage is paid to the Contractor. The Contractor shall execute such documentation and instructions respecting the interest-bearing escrow account as the Owner may require to protect its interests, including but not limited to a provision that no funds may be paid from the account to anyone without the Owner's advance written authorization.

B. Upon final completion, Owner shall pay an amount sufficient to increase total payments to Contractor to One-hundred (100) percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions.

C. Alternatives to Retainage

1. In lieu of retainage, Contractor, with the approval of Owner, may deposit a surety bond for all or any portion of the retainage in a form acceptable to Owner. Such bond and any proceeds therefrom shall be made subject to all claims and liens as provided for in ORS 279C.550 to 279C.620.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

ARTICLE 7 – CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds, attached hereto and incorporated herein as Exhibit B:
    a. Performance bond (together with power of attorney).
    b. Payment bond (together with power of attorney).
3. General Conditions, attached hereto and incorporated herein as Exhibit C. The General Conditions that are made a part of this Contract are EJCDC® C 700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee ("General Conditions"), and Owner has plainly shown all modifications to the standard wording of such published document to the Contractor in the Supplementary Conditions.
4. Supplementary Conditions, attached hereto and incorporated herein as Exhibit D.
5. Specifications, attached hereto and incorporated as Exhibit E.
6. Drawings, attached hereto and incorporated as Exhibit F.
8. Addenda (numbers **1** to **2**, inclusive).
9. Prevailing Wage Rates (not attached but incorporated by reference).
10. Payroll and Certified Statement Form (not attached but incorporated by reference).
12. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
    a. Notice to Proceed.
    b. Work Change Directives.
    c. Change Orders.
    d. Field Orders.
    e. Warranty Bond, if any.

B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement and incorporated herein (except as expressly noted otherwise above).

C. There are no Contract Documents other than those listed above in this Article 7.

D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 7—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 *Contractor's Representations*

A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:

1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions, if any, at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.
7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.
12. Contractor represents and warrants to Owner that (A) Contractor has the power and authority to enter into and perform this Contract; (B) this Contract, when executed and delivered, shall be a valid and binding obligation of Contractor enforceable in accordance

with its terms; (C) Contractor shall at all times during the term of this Contract, be qualified, professionally competent, and duly licensed to perform the Work; (D) Contractor is an independent contractor as defined in ORS 670.600; and (E) the Work under this Contract shall be performed in a good and workmanlike manner and in accordance with the highest professional standards. The warranties set forth in this section are in addition to, and not in lieu of, any other warranties provided.

13. Contractor represents and warrants that it has complied, and will continue to comply throughout the duration of this Contract and any extensions, with all tax laws of this state or any political subdivision of this state, including but not limited to ORS 305.620 and ORS chapters 316, 317, and 318. Any violation of this section shall constitute a material breach of this Contract and shall entitle Owner to terminate this Contract, to pursue and recover any and all damages that arise from the breach and the termination of this Contract, and to pursue any or all of the remedies available under this Contract or applicable law.

8.02 *Contractor's Certifications*

A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:

1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;

3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and

4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

B. Contractor shall furnish proof of required insurance in accordance with Paragraph 6.02 of the General Conditions and Supplemental General Conditions. Insurance certificates may be returned with the signed Agreement or may be emailed to Procurement@clackamas.us.

8.03 *Miscellaneous Terms*

A. Change Order Authorization. Throughout the performance of the Work under this Agreement, the Owner's Designated Representative (identified on the signature page) is hereby granted the authority to verbally authorize change orders in the field for an amount up to $10,000. As soon as possible following the authorization, the Owner's Designated Representative shall complete the change order form provided by Clackamas County Procurement ("Procurement"), obtain the signature of Owner's Director or other authorized signatory, and submit the form to Procurement for processing. As soon as the Director signs off on the change order form, the Designated Representative may then authorize another change order in the future for up to $10,000 following the same procedure above. Each change order should

include the cumulative cost of the entire change and may not be artificially broken up into multiple change orders to fall under the dollar threshold listed above. The authority granted to the Designated Representative is limited by the Director's authorization to amend the Agreement under Clackamas County's Local Contract Review Board Rules and is subject to the discretion of the Director, who may suspend or restrict the Designated Representative's ability to authorize change orders at any time for any reason.

B. Counterparts. This Contract may be executed in several counterparts, all of which when taken together shall constitute an agreement binding on all Parties, notwithstanding that all Parties are not signatories to the same counterpart. Each copy of the Contract so executed shall constitute an original.

C. Required Provisions. All provisions of state law required to be part of this Contract, whether listed in the General Conditions or Supplementary Conditions or otherwise, are hereby integrated and adopted herein. Contractor acknowledges the obligations thereunder and that failure to comply with such terms is a material breach of this Contract.

D. Integration. The Contract Documents constitute the entire agreement between the parties. There are no other understandings, agreements or representations, oral or written, not specified herein regarding this Contract. Contractor, by the signature below of its authorized representative, hereby acknowledges that it has read this Contract, understands it, and agrees to be bound by its terms and conditions.

Signature Page Follows

By their signatures below, Owner and Contractor agree to the terms, conditions, and content expressed in this Agreement.

Owner:

Water Environment Services

By: _____
(individual's signature)

Date: _____
(date signed)

Name: Tootie Smith
(typed or printed)

Title: Chair
(typed or printed)

Attest: _____
(individual's signature)

Title: _____
(typed or printed)

Address for giving notices:

ATTN: Gregory Geist

150 Beavercreek Road #430

Oregon City, OR 97045

Designated Representative:

Name: Steven Rice
(typed or printed)

Title: Project Manager
(typed or printed)

Address:

150 Beavercreek Road #430

Oregon City, OR 97045

Phone: 971-284-3710

Email: SRice@clackamas.us

Approved as to Form:

_____ 1/5/23

County Counsel

Contractor:

McClure and Sons, Inc.
(typed or printed name of organization)

By: _____
(individual's signature)

Date: 12/28/2022
(date signed)

Name: Les McClure
(typed or printed)

Title: President
(typed or printed)

Attest: _____
(individual's signature)

Title: Secretary
(typed or printed)

Address for giving notices:

ATTN: Les McClure

15714 Country Club Drive

Mill Creek, WA 98012

Designated Representative:

Name: Kyle Hansen
(typed or printed)

Title: Project Manager
(typed or printed)

Address:

15714 Country Club Drive

Mill Creek, WA 98012

Phone: 425-225-2033

Email: Hansen@mcclureandsons.com

License No.: 71127
(where applicable)

State: Oregon

EXHIBIT A

Contractors' Bid

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

BID FORM

PROJECT: #2022-83 Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation
BID CLOSING: October 19, 2022, 2:00 PM, Pacific Time
BID OPENING: October 19, 2022, 2:05 PM, Pacific Time

FROM: McClure and Sons, Inc.
Bidder's Name (must be full legal name, not ABN/DBA)

TO: Clackamas County
Procurement Division – procurement@clackamas.us

1. Bidder is (*check one of the following and insert information requested*):

____a. An individual; or

____b. A partnership registered under the laws of the State of _____; or

__X__c. A corporation organized under the laws of the State of Washington; or

____d. A limited liability corporation organized under the laws of the State of _____;

and authorized to do business in the State of Oregon hereby proposes to furnish all material and labor and perform all work hereinafter indicated for the above project in strict accordance with the Contract Documents for Milestone 1 (as defined in Specification Section 01 31 13 Project Coordination) for the Lump Sum Bid as follows:

TWO MILLION SIX HUNDRED FIFTY NINE Dollars ($ 2,659,430)
THOUSAND AND FOUR HUNDRED THIRTY
L.M and the Undersigned agrees to be bound by the following documents:

- Notice of Public Improvement Contract Opportunity
- Instructions to Bidders
- Bid Bond
- Public Improvement Contract Form
- General Conditions
- Prevailing Wage Rates
- Plans, Specifications and Drawings
- Supplemental Instructions to Bidders
- Bid Form
- Performance Bond and Payment Bond
- Supplemental General Conditions
- Payroll and Certified Statement Form

- ADDENDA numbered 1 through 5, inclusive *(fill in blanks)*
(2 ADDENDUMS, AND 3 CLARIFYING QUESTIONS)

2. The Undersigned proposes to add to the Lump Sum Bid indicated above the items or work relating to the following Unit Prices as designated in the Specifications, for which any adjustments in the Contract amount will be made in accordance with the General Conditions. Estimated Quantities include Work in Primary Clarifiers 1, 2, 3, 4, 5 and 6. See Additive Alternate description below. If Owner does not elect to award Additives Alternate(s) the Estimated Quantities of Unit Price Work are expected to be substantially less than the total for all six clarifiers. If Owner does elect to award Additive Alternate(s), the Bid Unit Prices for Work for Items No. ~~5~~-8 through ~~12~~-21 will be factored at the time of Alternate award in the same manner described below. Bidder acknowledges Supplementary Conditions Article 13.03 which relates to no adjustment of unit prices related to bid alternate quantities.

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Amount
1	Primary influent channel vertical, horizontal and overhead concrete surface removal and repair adjacent to Primary Clarifiers 1 and 2 - 5/8 to 1 inch removal depth and repair thickness	SF	1,200	$ 32	$ 38,400
2	Primary influent channel vertical horizontal, and overhead concrete surface removal and repair adjacent to Primary Clarifiers 1 and 2 – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	1,200	$ 12	$ 14,400
3	Primary clarifiers 1 and 2 vertical~~,~~ and horizontal~~, and overhead~~ concrete surface removal and repair - 5/8 to 1 inch removal depth and repair thickness	SF	~~19,700~~14,700	$ 13	$ 191,100
4	Primary clarifiers 1 and 2 vertical~~,~~ and horizontal~~, and overhead~~ concrete surface removal and repair – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	~~19,700~~14,700	$ 12	$ 176,400
5	Primary clarifiers 1 and 2 overhead concrete surface removal and repair - 0 to 1/2 inch removal depth and repair thickness	SF	5,000	$ 30	$ 150,000
6	Primary clarifiers 1 and 2 overhead concrete surface removal and repair - 5/8 to 1 inch removal depth and repair thickness	SF	5,000	$ 11	$ 55,000

7	Primary clarifiers 1 and 2 overhead concrete surface removal and repair – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	5,000	$	8	$	40,000
~~5~~8	Primary influent channel vertical, horizontal and overhead concrete surface removal and repair adjacent to Primary Clarifiers 3 and 4 - 5/8 to 1 inch removal depth and repair thickness	SF	1,200	$	33	$	39,600
~~6~~9	Primary influent channel vertical horizontal, and overhead concrete surface removal and repair adjacent to Primary Clarifiers 3 and 4 – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	1,200	$	12	$	14,400
~~7~~10	Primary clarifiers 3 and 4 vertical~~,~~ and horizontal~~, and overhead~~ concrete surface removal and repair - 5/8 to 1 inch removal depth and repair thickness	SF	~~19,700~~14,700	$	17	$	249,900
~~8~~11	Primary clarifiers 3 and 4 vertical~~,~~ and horizontal~~, and overhead~~ concrete surface removal and repair – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	~~19,700~~14,700	$	16	$	235,200
12	Primary clarifiers 3 and 4 overhead concrete surface removal and repair - 0 to 1/2 inch removal depth and repair thickness	SF	5,000	$	31	$	155,000
13	Primary clarifiers 3 and 4 overhead concrete surface removal and repair - 5/8 to 1 inch removal depth and repair thickness	SF	5,000	$	11	$	55,000
14	Primary clarifiers 3 and 4 overhead concrete surface removal and repair – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	5,000	$	8	$	40,000
~~9~~15	Primary influent channel vertical, horizontal and overhead concrete surface removal and repair adjacent to Primary Clarifiers 5	SF	1,200	$	34	$	40,800

	and 6 - 5/8 to 1 inch removal depth and repair thickness				
~~10~~16	Primary influent channel vertical horizontal, and overhead concrete surface removal and repair adjacent to Primary Clarifiers 5 and 6 – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	1,200	$ 13	$ 15,600
~~11~~17	Primary clarifiers 5 and 6 vertical~~,~~ and horizontal~~, and overhead~~ concrete surface removal and repair - 5/8 to 1 inch removal depth and repair thickness	SF	~~19,700~~14,700	$ 18	$ 264,600
~~12~~18	Primary clarifiers 5 and 6 vertical~~,~~ and horizontal~~, and overhead~~ concrete surface removal and repair – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	~~19,700~~14,700	$ 17	$ 249,900
19	Primary clarifiers 5 and 6 overhead concrete surface removal and repair - 0 to 1/2 inch removal depth and repair thickness	SF	5,000	$ 32	$ 160,000
20	Primary clarifiers 5 and 6 overhead concrete surface removal and repair - 5/8 to 1 inch removal depth and repair thickness	SF	5,000	$ 12	$ 60,000
21	Primary clarifiers 5 and 6 overhead concrete surface removal and repair – 1-1/8 to 1-1/2 inch removal depth and repair thickness	SF	5,000	$ 9	$ 45,000
~~5~~ 22	Total of All Unit Price Bid Items (Subtotal)				$ 2,290,300
Notes: 1. Vertical~~,~~ and horizontal~~, and overhead~~ concrete removal and repair from 0 to ½ inch depth and all associated costs shall be included in the lump sum bid price for the primary influent channel and each of six primary clarifiers.					

The Undersigned acknowledges that:

a. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and

b. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.

3. Major Equipment Schedule:

a. Bidder agrees to accept as full payment for furnishing the items listed, and any Work necessary to install the items, for the unit prices included in the "Bid Column" column for each item.

b. Bidder must provide a Bid Amount for all Item A products, to be considered responsive.

c. The Bid Amount price shall include the number of units in the Bidding Documents and all associated equipment and systems identified in the specification sections listed as the responsibility of the equipment manufacturer.

d. Bidder Proposed Alternative:

1) Bidder may propose an "or-equal" alternate by including the Manufacturer's or Supplier's name and model number for items where a blank has been provided.

2) Evaluation and selection of alternatives will be made after selection of the Contractor.

3) Selection of the alternate to be provided will be made by Owner from those priced by Bidder as best serves the interest of Owner.

4) Include in the Alternative Amount for Bidder-proposed alternates the cost of Work and redesign and construction changes, including, but not limited to, electrical, mechanical, structural, and any other modifications to the Work necessary to make the several parts fit together and perform as specified. In addition to cost changes, please include any potential impacts to schedule as well.

5) Any schedule delays caused by Owner's selection of an alternate other than Item A will not constitute grounds for a contract adjustment.

6) The Bidder must include the subtotal cost of all the "A" listed items in this Section in the blank space provided.

Major Equipment Schedule			
Section 44 42 24.02 Rectangular Primary Clarifier Mechanism			
Item	Manufacturer or Supplier	Alternative Amount	Bid Amount
A	Brentwood/Polychem Systems		$ 2,100,000
B	Evoqua	$ NO BID	
C		$	
	Major Equipment Schedule Bid Amount (A-named item):		$ 2,100,000

4. Total Base Bid Price (Lump Sum and Unit Prices):

Base Bid Summary: Enter Amount from Previous Subtotals

Lump Sum Bid Price	$	2,659,430
Total of All Unit Price Bid Items 1 through 47	$	665,300
Major Equipment Schedule Bid Amount	$	2,100,000

TOTAL BASE BID PRICE (TOTAL OF ALL LUMP SUM AND UNIT PRICE BIDS AND MAJOR EQUIPMENT SCHEDULE):

FIVE MILLION FOUR HUNDRED TWENTY FOUR THOUSAND, SEVEN HUNDRED THIRTY Dollars ($ 5,424,730)

Additive Bid Alternate:

Bidder must provide a Bid Amount for all Bid Alternates be considered responsive.

The Bid Price shall include the number of units in the Bidding Documents and all associated equipment and systems identified in the specification sections within Bid Documents for work described.

Additive Bid Alternates

Bid Alternate 1: Work of Milestone 2 Lump Sum Bid Price and Total Unit Price Bid Items ~~5~~-8 through ~~8~~14	$	3,629,100
Bid Alternate 2: Work of Milestone 3 Lump Sum Bid Price and Total Unit Price Bid Items ~~9~~-15 through ~~12~~21	$	3,581,903

Note: The Work of Project Milestones is defined in Specification Section 01 31 13 Project Coordination

For the Bidder that is awarded the Contract, Bid price for all Bid Alternates shall remain valid for a period up to 400 days following the Bid Opening. Owner may choose to Award Bid Alternates during this same 400 day period. For All Bid Alternates not Awarded at time of Award of Base Bid, Bid Price for each Bid Alternate will be factored at the time of Award by the Engineering News Record, Construction Cost Index 20 City Average (ENR-CCI20) in accordance with the following formula.

Factored Bid Alternate Price = Bid Alternate Price * [ENR CCI20 (Month Prior to Bid Alternate Award)] / [ENR CCI20 (Month of Bid Opening)].

If Owner declines to award Bid Alternates, Bidder shall be bound to provide equipment for all 6 primary clarifier basins including those procured, but not installed under Base Bid to Owner, not later than Substantial Completion date for Base Bid.

5. The successful Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement. The Bidder accepts the provisions of the Agreement as to liquidated damages.

6. Accompanying herewith is Bid Security which is equal to ten percent (10%) of the total amount of the Basic Bid, plus the total sum of all Alternatives (if any).

7. The Undersigned agrees, if awarded the Contract, to execute and deliver to Clackamas County, within twenty (20) calendar days after receiving the Contract forms, a Contract Form, and a satisfactory Performance Bond and Payment Bond each in an amount equal to one hundred percent (100%) of the Contract sum, using forms provided by the Owner. The surety requested to issue the Performance Bond and Payment Bond will be:

Travelers Casualty and Surety
(name of surety company - not insurance agency)

The Undersigned hereby authorizes said surety company to disclose any information to the Owner concerning the Undersigned's ability to supply a Performance Bond and Payment Bond each in the amount of the Contract.

8. The Undersigned further agrees that the Bid Security accompanying the Bid is left in escrow with Clackamas County; that the amount thereof is the measure of liquidated damages which the Owner will sustain by the failure of the Undersigned to execute and deliver the above-named Contract Form, Performance Bond and Payment Bond, each as published, and that if the Undersigned defaults in either executing the Contract Form or providing the Performance Bond and Payment Bond within twenty (20) calendar days after receiving the Contract forms, then the Bid Security shall become the property of the Owner at the Owner's option; but if the Bid is not accepted within thirty (30) calendar days of the time set for the opening of the Bids, or if the Undersigned executes and timely delivers said Contract Form, Performance Bond and Payment Bond, the Bid Security shall be returned.

9. The Undersigned certifies that: (i) This Bid has been arrived at independently and is being submitted without collusion with and without any agreement, understanding, or planned common course of action with any other vendor of materials, supplies, equipment or services described in the invitation to bid designed to limit independent bidding or competition; and (ii) the contents of the Bid have not been communicated by the Undersigned or its employees or agents to any person not an employee or agent of the Undersigned or its surety on any Bond furnished with the Bid and will not be communicated to such person prior to the official opening of the Bid.

10. The undersigned ☒ **HAS,** ☐ **HAS NOT** (*check one*) paid unemployment or income taxes in Oregon within the past 12 months and ☒ **DOES,** ☐ **DOES NOT** (*check one*) a business address in Oregon. The undersigned acknowledges that, if the selected bidder, that the undersigned will have to pay all applicable taxes and register to do business in the State of Oregon before executing the Contract Form.

11. The Undersigned agrees, if awarded a contract, to comply with the provisions of ORS 279C.800 through 279C.870 pertaining to the payment of the prevailing rates of wage.

12. Contractor's CCB registration number is 71127. As a condition to submitting a bid, a Contractor must be registered with the Oregon Construction Contractors Board in accordance with ORS 701.035 to 701.055, and disclose the registration number. Failure to register and disclose the number will make the bid unresponsive and it will be rejected, unless contrary to federal law.

13. The successful Bidder hereby certifies that all subcontractors who will perform construction work as described in ORS 701.005(2) were registered with the Construction Contractors Board in accordance with ORS 701.035 to 701.055 at the time the subcontractor(s) made a bid to work under the contract.

14. The successful Bidder hereby certifies that, in compliance with the Worker's Compensation Law of the State of Oregon, its Worker's Compensation Insurance provider is SAIF, Policy No. 783869, and that Contractor shall submit Certificates of Insurance as required.

15. Contractor's Key Individuals for this project (supply information as applicable):

Project Executive: Jon Varriano, Cell Phone: (206) 730-1665,
Project Manager: Kyle Hansen, Cell Phone: (206) 963-2371,
Job Superintendent: Scott Crawford, Cell Phone: (541) 505-2404,
Project Engineer: Patrick Randles, Cell Phone: (503) 970-4445.

16. The Undersigned certifies that it has not discriminated against minority, women, or emerging small businesses in obtaining any subcontracts for this project.

17. The Undersigned certifies that it has a drug testing program in accordance with ORS 279C.505.

REMINDER: Bidder must submit the below First-Tier Subcontractor Disclosure Form.

By signature below, Contractor agrees to be bound by this Bid.

NAME OF FIRM McClure and Sons, Inc.

ADDRESS 15714 Country Club Drive

Mill Creek WA 98012

TELEPHONE NO (425) 316-6999

EMAIL bids@mcclureandsons.com les@mcclureandsons.com

SIGNATURE 1) _____
Sole Individual

or 2) _____
Partner

or 3) _____
Authorized Officer or Employee of Corporation

* * * * * ***END OF BID*** * * * * *

FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM
PROJECT: 2022-83 Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

BID OPENING: October ~~13~~19, 2022, 2:00 PM, Pacific Time

Failure to submit this Form by the disclosure deadline will result in a nonresponsive bid.

INSTRUCTIONS:
This First-Tier Subcontractor Disclosure Form ("Form") must be submitted and received at the location specified in the Notice of Public Improvement Contract Opportunity on the advertised Bid Closing, and within two working hours after the advertised Bid Closing Time.

The Form may be mailed, hand-delivered or emailed to: Procurement@clackamas.us. It is the responsibility of Bidders to submit this Form and any additional sheets with the Project name clearly marked on the envelope or the subject line of the email.

Subcontractor lists may be submitted with the bid in the same envelope or email at the Bid Closing date and time. Subcontractor lists **MUST** be submitted within **two (2) hours** of the Bid Closing date and time.

List below the name of each subcontractor that will be furnishing labor, or labor and materials, for which disclosure is required, the category of work that the subcontractor will be performing, and the dollar value of the subcontract. Enter **"NONE"** if the value of the project bid is less than $100,000 or there are no subcontractors that need to be disclosed. ATTACH ADDITIONAL SHEETS IF NECESSARY.

	SUBCONTRACTOR NAME	DOLLAR VALUE	CATEGORY OF WORK
1.	S+S ELECTRICAL CONTRACTORS LLC	478,977 BID 159,400 ADD#1 159,400 ADD#2	ELECTRICAL, INC.
2.	DN TANK	1,533,440 BASE BID	CONCRETE REPAIR
3.		1,594,090 ADD#1	
4.		1,654,620 ADD#2	
5.			
6.			

The above listed first-tier subcontractor(s) are providing labor, or labor and material, with a Dollar Value equal to or greater than:

a) 5% of the total Contract Price, but at least $15,000. If the Dollar Value is less than $15,000 do not list the subcontractor above; or
b) $350,000 regardless of the percentage of the total Contract Price.

Firm Name: McClure and Sons, Inc.

Bidder Signature: _____ Phone # (425) 316-6999

CLACKAMAS COUNTY
GOOD FAITH EFFORT
SUBCONTRACTOR AND SELF-PERFORMED WORK LIST
(FORM 1)

3,629,100
ADDITIVE #1
3,581,903
ADDITIVE #2

Prime Contractor Name: McClure and Sons, Inc. **Total Contract Amount:** $5,424,730

Project Name: BID #2022-83 Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation BASE BID

PRIME SELF-PERFORMING: Identify below **ALL** GFE Divisions of Work (DOW) to be self-performed. Good Faith Efforts are otherwise required.

DOW BIDDER WILL SELF-PERFORM *(GFE not required)*	
MECHANICAL PIPING	
MECHANICAL DEMOLITION	
MECHANICAL EQUIPMENT	
METAL DOORS & FRAMES	

PRIME CONTRACTOR SHALL DISCLOSE AND LIST ALL SUBCONTRACTORS, including those Minority-owned, Woman-owned, and Emerging Small Businesses ("M/W/ESB") that you intend to use on the project. Hand delivery to Procurement, 2051 Kaen Road, Oregon City, OR 97045 or email to procurement@clackamas.us within 2 hours of the BID/Quote Closing Date/Time

LIST ALL SUBCONTRACTORS BELOW Use **correct legal name** of Subcontractor (No Assumed Business Names)	**Division of Work** (Painting, electrical, landscaping, etc.) List **ALL** DOW performed by Subcontractors	**DOLLAR AMOUNT OF SUBCONTRACT**	If Certified or self-reporting MBE/WBE/ESB Subcontractor Check box ☑		
			MBE	WBE	ESB
Name DN TANKS Address 315 CYPRESS LANE City/St/Zip EL CAJON, CA 92020 Phone# (619) 440-8181 OCCB# 236987	CONCRETE REPAIR	~~$1,895,000~~ 1,533,440 LM BASE BID 1,594,090 ADD #1 1,654,620 ADD #2	☐	☐	☐
Name MJE INDUSTRIAL Address PO BOX 3434 City/St/Zip GRESHAM, OR 97030 Phone# 503 936-8934 OCCB# 227416	PAINTING	$41,718 BASE BID ONLY	☐	☐	☒
Name S&S ELECTRICAL CONTRACTORS Address PO BOX 1789 City/St/Zip MCMINNVILLE, OR 97128 Phone# (971) 241-7475 OCCB# 189180	ELECTRICAL	$478,977 BASE BID 159,400 ADD #1 159,400 ADD #2	☐	☐	☐
Name SANTIAM HEATING & SHEETMETAL Address 41713 STAYTON SCIO ROAD City/St/Zip STAYTON, OR 97383 Phone# (503) 769-8483 OCCB# 104080	HVAC	$52,700 BASE BID ONLY	☐	☐	☐

CLACKAMAS COUNTY
GOOD FAITH EFFORT
M/W/ESB CONTACT / BIDS RECEIVED LOG
(FORM 2)

Prime Contractor: McClure and Sons, Inc.

Project: BID #2022-83 Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

Prime Contractor must contact or endeavor to contact at least 3 M/W/ESB Subcontractors for each Division of Work. Prime Contractor shall record its contacts with M/W/ESB Subcontractors through use of this log (or equivalent) entering all required information. All columns shall be completed where applicable. Additional forms may be copied if needed.

NAME OF M/W/ESB SUBCONTRACTOR	Divisions of Work (Painting, electrical, landscaping, etc.)	Date Solicitation Letter / Fax Sent	PHONE CONTACT		BID ACTIVITY Check Yes or No			REJECTED BIDS (if bid received & not used)		Notes
			Date of Call	Person Receiving Call	Will Bid	Bid Received	Bid Used	Bid Amount	Reason Not Used (Price, Scope or Other. If Other, explain in Notes>>)	
THE RODRIGUEZ CORP. (503) 245-0679	PAINTING	9/26/22	10/3/22	FERNANDO	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
MJE INDUSTRIAL (503) 936-8934	PAINTING	9/26/22	10/3/22	LEFT VOICE MAIL FOR SCOTT CALLED BACK	☒ Yes ☐ No	☒ Yes ☐ No	☒ Yes ☐ No	$41,718		
W.E. GIVEN CONTRACTING (503) 655-3662	PAINTING	9/26/22	10/3/22	KIM TINGLEY	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
MATTHEW T JOHNSON (503) 438-6957	CONCRETE REPAIR	9/26/22	10/3/22	LEFT VOICE MAIL FOR MATT	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
OREGON ASPHALT MAINTENANCE (541) 451-4687	CONCRETE REPAIR	9/26/22	10/3/22	FISHER - NOT BIDDING	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	OUT OF AREA OF SERVICE
ROSE CITY CONCRETE REPAIR (503) 232-9702	CONCRETE REPAIR	9/26/22	10/3/22	LEFT VOICE MAIL FOR MELISSA	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
AFFORDABLE ELECTRIC (503) 305-6975	ELECTRICAL	9/26/22	10/3/22	RINGS AND NO ANSWER	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	

CLACKAMAS COUNTY
GOOD FAITH EFFORT
M/W/ESB CONTACT / BIDS RECEIVED LOG
(FORM 2)

Prime Contractor: McClure and Sons, Inc.

Project: BID #2022-83 Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

Prime Contractor must contact or endeavor to contact at least 3 M/W/ESB Subcontractors for each Division of Work. Prime Contractor shall record its contacts with M/W/ESB Subcontractors through use of this log (or equivalent) entering all required information. All columns shall be completed where applicable. Additional forms may be copied if needed.

NAME OF M/W/ESB SUBCONTRACTOR	Divisions of Work (Painting, electrical, landscaping, etc.)	Date Solicitation Letter / Fax Sent	PHONE CONTACT		BID ACTIVITY Check Yes or No			REJECTED BIDS (if bid received & not used)		Notes
			Date of Call	Person Receiving Call	Will Bid	Bid Received	Bid Used	Bid Amount	Reason Not Used (Price, Scope or Other. If Other, explain in Notes>>)	
SUNDANCER ELECTRIC (253) 398-2999	ELECTRICAL	9/26/22	10/3/22	JAY	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
WIRENUT ENTERPRISES (503) 504-7960	ELECTRICAL	9/26/22	10/3/22	JAN	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
ANDERSEN MECHANICAL (503) 841-0742	HVAC	9/26/22	10/3/22	ART	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
RIVER CITY NW MECHANICAL (503) 591-9950	HVAC	9/26/22	10/3/22	KARLEE	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
RESOLUTE CONSTRUCTION (503) 593-2490	HVAC	9/26/22	10/3/22	LEFT VOICE MAIL FOR KRISTIN	☐ Yes ☒ No	☐ Yes ☒ No	☐ Yes ☒ No		NO BID	
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			
					☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No			

CLACKAMAS COUNTY

CLACKAMAS COUNTY
PUBLIC IMPROVEMENT CONTRACT

BID BOND

Project Name: # 2022-83 Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

We, McClure and Sons, Inc., as "Principal,"
(Name of Principal)

and Travelers Casualty and Surety Company of America, an Connecticut Corporation,
(Name of Surety)

authorized to transact Surety business in Oregon, as "Surety," hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns to pay unto Clackamas County ("Obligee") the sum of ($ 10%)

--Ten Percent of the Amount Bid-- dollars.

WHEREAS, the condition of the obligation of this bond is that Principal has submitted its proposal or bid to an agency of the Obligee in response to Obligee's procurement document (No.) for the project identified above which proposal or bid is made a part of this bond by reference, and Principal is required to furnish bid security in an amount equal to ten (10%) percent of the total amount of the bid pursuant to the procurement document.

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

IN WITNESS WHEREOF, we have caused this instrument to be executed and sealed by our duly authorized legal representatives this 19th day of October, 2022.

Principal: McClure and Sons, Inc.

By: _____
Signature

Lee McClure, President
Official Capacity

Attest: _____
Corporation Secretary

Surety: Travelers Casualty and Surety Company of America

By: Attorney-In-Fact

Travis Long
Name

835 N. Post Street, Suite 203
Address

Spokane WA 99201
City State Zip

509-747-3121 509-623-1073
Phone Fax

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Travis Long** of **SPOKANE**, **Washington**, their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this **19th** day of **October**, **2022**.

Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

EXHIBIT B

Bonds

CLACKAMAS WATER ENVIRONMENT SERVICES

WATER ENVIRONMENT SERVICES
PUBLIC IMPROVEMENT CONTRACT

PERFORMANCE BOND

Bond No.: 107712611
Solicitation: #2022-83
Project Name: Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

Travelers Casualty and Surety Company of America (Surety #1)	Bond Amount No. 1:	$ 5,424,730.00
N/A (Surety #2)*	Bond Amount No. 2:*	$ N/A
** If using multiple sureties*	Total Penal Sum of Bond:	$ 5,424,730.00

We, McClure and Sons, Inc. as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto Water Environment Services ("District"), the sum of (Total Penal Sum of Bond) $--FiveMillion Four Hundred Twenty-Four Thousand Seven HundredThirty and No/100-- (Provided, that we the Sureties bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety); and

WHEREAS, the Principal has entered into a contract with the District, along with the plans, specifications, terms and conditions of which are contained in the above-referenced Project Contract Documents; and

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Performance Bond by reference, whether or not attached to the contract (all hereafter called "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and all authorized modifications of the Contract which increase the amount of the work, the amount of the Contract, or constitute an authorized extension of the time for performance, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal herein shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things undertaken by Contractor to be performed under the Contract, upon the terms set forth therein, and within the time prescribed therein, or as extended as provided in the Contract, with or without notice to the Sureties, and shall defend, indemnify, and save harmless the District and Clackamas County and their elected officials, officers, employees and agents, against any direct or indirect damages or claim of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Principal or its subcontractors, and shall in all respects perform said contract according to law, then this obligation is to be void; otherwise, it shall remain in full force and effect for so long as any term of the Contract remains in effect.

Nonpayment of the bond premium will not invalidate this bond nor shall the District, be obligated for the payment of any premiums.

This bond is given and received under authority of Oregon Revised Statutes Chapter 279C and the Clackamas County Local Contractor Review Board Rules, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES.

Dated this 14th day of December, 20 22.

PRINCIPAL: McClure and Sons, Inc.

By: _____
Signature

Les McClure, President
Official Capacity

Attest: _____
Corporation Secretary

SURETY: Travelers Casualty and Surety Company of America

[Add signatures for each if using multiple bonds]

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany each bond]

Travis Long, Attorney-in-Fact
Name

_____
Signature

835 N. Post Street, Suite 203
Address

Spokane	WA	99201
City	State	Zip
(509) 747-3121	(509) 623-1073	
Phone	Fax	

CLACKAMAS WATER ENVIRONMENT SERVICES

WATER ENVIRONMENT SERVICES
PUBLIC IMPROVEMENT CONTRACT

PAYMENT BOND

Bond No.: 107712611
Solicitation: #2022-83
Project Name: Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

Travelers Casualty and Surety Company of America (Surety #1)	Bond Amount No. 1:	$ 5,424,730.00
N/A (Surety #2)*	Bond Amount No. 2:*	$ N/A
* *If using multiple sureties*	Total Penal Sum of Bond:	$ 5,424,730.00

We, McClure and Sons, Inc., as Principal, and the above identified Surety(ies), authorized to transact surety business in Oregon, as Surety, hereby jointly and severally bind ourselves, our respective heirs, executors, administrators, successors and assigns firmly by these presents to pay unto Water Environment Services ("District"), the sum of (Total Penal Sum of Bond) --Five Million Four Hundred Twenty-Four Thousand Seven Hundred Thirty and No/100-- (Provided, that we the Sureties bind ourselves in such sum "jointly and severally" as well as "severally" only for the purpose of allowing a joint action or actions against any or all of us, and for all other purposes each Surety binds itself, jointly and severally with the Principal, for the payment of such sum only as is set forth opposite the name of such Surety); and

WHEREAS, the Principal has entered into a contract with the District, along with the plans, specifications, terms and conditions of which are contained in above-referenced Project Contract Documents; and

WHEREAS, the terms and conditions of the contract, together with applicable plans, standard specifications, special provisions, schedule of performance, and schedule of contract prices, are made a part of this Payment Bond by reference, whether or not attached to the contract (all hereafter called "Contract"); and

WHEREAS, the Principal has agreed to perform the Contract in accordance with the terms, conditions, requirements, plans and specifications, and schedule of contract prices which are set forth in the Contract and any attachments, and all authorized modifications of the Contract which increase the amount of the work, or the cost of the Contract, or constitute authorized extensions of time for performance of the Contract, notice of any such modifications hereby being waived by the Surety:

NOW, THEREFORE, THE CONDITION OF THIS BOND IS SUCH that if the Principal shall faithfully and truly observe and comply with the terms, conditions and provisions of the Contract, in all respects, and shall well and truly and fully do and perform all matters and things by it undertaken to be performed under said Contract and any duly authorized modifications that are made, upon the terms set forth therein, and within the time prescribed therein, or as extended therein as provided in the Contract, with or without notice to the Sureties, and shall defend, indemnify, and save harmless the District and Clackamas County and their elected officials, officers, employees and agents, against any claim for direct or indirect damages of every kind and description that shall be suffered or claimed to be suffered in connection with or arising out of the performance of the Contract by the Contractor or its subcontractors, and shall promptly pay all persons supplying labor, materials or both to the Principal or its subcontractors for prosecution of the work provided in the Contract; and shall promptly pay all contributions due the State Industrial Accident Fund and the State Unemployment Compensation Fund from the Principal or its subcontractors in connection with the performance of the Contract; and shall pay over to the Oregon Department of Revenue all sums required to be deducted and retained from the wages of employees of the Principal and its subcontractors pursuant to ORS 316.167, and shall permit no lien nor claim to be filed or prosecuted against the District on account of any labor or materials furnished; and shall do all things required of

the Principal by the laws of this State, then this obligation shall be void; otherwise, it shall remain in full force and effect for so long as any term of the Contract remains in effect.
Nonpayment of the bond premium will not invalidate this bond nor shall the District be obligated for the payment of any premiums.

This bond is given and received under authority of Oregon Revised Statutes Chapter 279C and the Clackamas County Local Contractor Review Board Rules, the provisions of which hereby are incorporated into this bond and made a part hereof.

IN WITNESS WHEREOF, WE HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES:

Dated this 14th day of December, 20 22.

PRINCIPAL: McClure and Sons, Inc.

By: _____
Signature

Les McClure, President
Official Capacity

Attest: _____
Corporation Secretary

SURETY: Travelers Casualty and Surety Company of America

[Add signatures for each if using multiple bonds]

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany each bond]

Travis Long, Attorney-in-Fact
Name

_____
Signature

835 N. Post Street, Suite 203
Address

Spokane	WA	99201
City	State	Zip

(509) 747-3121	(509) 623-1073
Phone	Fax

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Travis Long** of **SPOKANE** , **Washington** , their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this **14th** day of **December** , **2022** .

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

CLACKAMAS WATER ENVIRONMENT SERVICES

WATER ENVIRONMENT SERVICES
PUBLIC IMPROVEMENT CONTRACT

RETAINAGE BOND

Bond No.: _107736717_____
Solicitation: #2022-83
Project Name: Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation

Travelers Casualty and Surety Company of America__(Surety) Total Penal Sum of Bond: $ 271,236.50___

KNOW ALL PERSONS BY THESE PRESENTS,

That _McClure and Sons, Inc._____("Principal"), a _Corporation_____,
(Name of Contractor) (Corporation, individual, partnership)

existing under and by virtue of the laws of the State of ___WA___ and authorized to do business in the State of

Oregon, and _Travelers Casualty and Surety Company of America__ ("Surety") are jointly and severally held and bound unto
(Name of Surety)
Water Environment Services ("District") in the sum of _Two Hundred Seventy One Thousand Two Hundred Thirty Six and 50/100_____ Dollars

($ 271,236.50) ("Total Penal Bond Sum") which sum represents five percent (5%) of the Contract Amount on

District Contract No.__7262_____ ("Contract").

WHEREAS, on the _14th__ day of December 20 22__, the Principal herein executed the Contract with the District for
the following described construction project:
_____Tri-City Water Resource Recovery Facility (WRRF) Primary Clarifier Rehabilitation _____

WHEREAS, the Contract requires, and ORS 279C.570 allows, the District to reserve as retainage from any progress payment an amount not to exceed five percent from money earned on estimates during the progress of construction, in protection of the District's interests.

IN THIS CASE, the District and Principal agree to reserve as retainage 5% (five percent) of any progress payments.

WHEREAS, the District has agreed to allow a retainage bond in lieu of earned and retained funds for amounts to be withheld.

WHEREAS, the retainage shall be withheld and released in accordance with ORS 279C.555 through 279C.570.

NOW THEREFORE, the parties agree to the following:

1. The condition of this obligation is such that the Surety is held and bound unto the District for the Total Penal Bond Sum, which shall include any increases due to change orders, increases in quantities of work or the addition of any new item of work, so long as such increases or additions do not cause the face value of this bond to be exceeded. For any change orders or increases that would cause the amount of retainage to be withheld to be greater than the Total Penal Bond Sum, the District will retain such additional sums as

necessary to maintain compliance with the District requirement of 5% withheld in accordance with ORS 279C.555 through 279C.570.

2. Neither final payment nor any remaining retained percentage shall become due until the Principal has met all the requirements which would entitle final payment under the terms of the Contract. The terms of the Contract are hereby incorporated by reference.
3. District may require payment of all or a portion of the Total Penal Bond Sum for any purpose authorized by the Contract, in which case District will provide Surety with a written demand at _835 N. Post Street, Suite 203. Spokane, WA 99201__(address), with an explanation for the reason of the demand. Surety will pay the bond amount within ten (10) days of receiving the demand.

IN WITNESS WHEREOF, THE PARTIES HAVE CAUSED THIS INSTRUMENT TO BE EXECUTED AND SEALED BY OUR DULY AUTHORIZED LEGAL REPRESENTATIVES:

Dated this ___14th_____day of ___December_____, 20_22___.

PRINCIPAL: _McClure and Sons, Inc._____

By: _____
Signature Les McClure

____President
Official Capacity

Attest: _____
Corporation Secretary

SURETY: Travelers Casualty and Surety Company of America

BY ATTORNEY-IN-FACT:
[Power-of-Attorney must accompany bond]

_Diana R Williams, Attorney-in-Fact_____
Name

_____
Signature

835 N. Post Street, Suite 203_____
Address

Spokane_____WA_____99201___
City State Zip

509-747-3121_____509-623-1073_____
Phone Fax

TRAVELERS

Travelers Casualty and Surety Company of America
Travelers Casualty and Surety Company
St. Paul Fire and Marine Insurance Company

POWER OF ATTORNEY

KNOW ALL MEN BY THESE PRESENTS: That Travelers Casualty and Surety Company of America, Travelers Casualty and Surety Company, and St. Paul Fire and Marine Insurance Company are corporations duly organized under the laws of the State of Connecticut (herein collectively called the "Companies"), and that the Companies do hereby make, constitute and appoint **Diana R Williams** of **SPOKANE** , **Washington** , their true and lawful Attorney(s)-in-Fact to sign, execute, seal and acknowledge any and all bonds, recognizances, conditional undertakings and other writings obligatory in the nature thereof on behalf of the Companies in their business of guaranteeing the fidelity of persons, guaranteeing the performance of contracts and executing or guaranteeing bonds and undertakings required or permitted in any actions or proceedings allowed by law.

IN WITNESS WHEREOF, the Companies have caused this instrument to be signed, and their corporate seals to be hereto affixed, this **21st** day of **April**, **2021**.

State of Connecticut

City of Hartford ss.

By: _____
Robert L. Raney, Senior Vice President

On this the **21st** day of **April**, **2021**, before me personally appeared **Robert L. Raney**, who acknowledged himself to be the Senior Vice President of each of the Companies, and that he, as such, being authorized so to do, executed the foregoing instrument for the purposes therein contained by signing on behalf of said Companies by himself as a duly authorized officer.

IN WITNESS WHEREOF, I hereunto set my hand and official seal.

My Commission expires the **30th** day of **June**, **2026**

_____
Anna P. Nowik, Notary Public

This Power of Attorney is granted under and by the authority of the following resolutions adopted by the Boards of Directors of each of the Companies, which resolutions are now in full force and effect, reading as follows:

RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President, any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary may appoint Attorneys-in-Fact and Agents to act for and on behalf of the Company and may give such appointee such authority as his or her certificate of authority may prescribe to sign with the Company's name and seal with the Company's seal bonds, recognizances, contracts of indemnity, and other writings obligatory in the nature of a bond, recognizance, or conditional undertaking, and any of said officers or the Board of Directors at any time may remove any such appointee and revoke the power given him or her; and it is

FURTHER RESOLVED, that the Chairman, the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President may delegate all or any part of the foregoing authority to one or more officers or employees of this Company, provided that each such delegation is in writing and a copy thereof is filed in the office of the Secretary; and it is

FURTHER RESOLVED, that any bond, recognizance, contract of indemnity, or writing obligatory in the nature of a bond, recognizance, or conditional undertaking shall be valid and binding upon the Company when (a) signed by the President, any Vice Chairman, any Executive Vice President, any Senior Vice President or any Vice President, any Second Vice President, the Treasurer, any Assistant Treasurer, the Corporate Secretary or any Assistant Secretary and duly attested and sealed with the Company's seal by a Secretary or Assistant Secretary; or (b) duly executed (under seal, if required) by one or more Attorneys-in-Fact and Agents pursuant to the power prescribed in his or her certificate or their certificates of authority or by one or more Company officers pursuant to a written delegation of authority; and it is

FURTHER RESOLVED, that the signature of each of the following officers: President, any Executive Vice President, any Senior Vice President, any Vice President, any Assistant Vice President, any Secretary, any Assistant Secretary, and the seal of the Company may be affixed by facsimile to any Power of Attorney or to any certificate relating thereto appointing Resident Vice Presidents, Resident Assistant Secretaries or Attorneys-in-Fact for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, and any such Power of Attorney or certificate bearing such facsimile signature or facsimile seal shall be valid and binding upon the Company and any such power so executed and certified by such facsimile signature and facsimile seal shall be valid and binding on the Company in the future with respect to any bond or understanding to which it is attached.

I, **Kevin E. Hughes**, the undersigned, Assistant Secretary of each of the Companies, do hereby certify that the above and foregoing is a true and correct copy of the Power of Attorney executed by said Companies, which remains in full force and effect.

Dated this 14th day of December , 2022 .

_____
Kevin E. Hughes, Assistant Secretary

To verify the authenticity of this Power of Attorney, please call us at 1-800-421-3880.
Please refer to the above-named Attorney(s)-in-Fact and the details of the bond to which this Power of Attorney is attached.

EXHIBIT C

General Conditions

STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

Prepared By

Endorsed By

EJCDC® C-700, Standard General Conditions of the Construction Contract.
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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.

3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

5. *Bidder*—An individual or entity that submits a Bid to Owner.

6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.

7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.

8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.

9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.

10. *Claim*

a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract Price or Contract Times; contesting an initial decision by Engineer concerning the

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requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.

b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.

c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.

d. A demand for money or services by a third party is not a Claim.

11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.

12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.

13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.

14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.

15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.

16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.

17. *Cost of the Work*—See Paragraph 13.01 for definition.

18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.

19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.

20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.

21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions, including sending and receipt; (c) printing of the transmitted Electronic Document by the

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recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.

23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.

24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.

    a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.

    b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.

    c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.

25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.

27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.

28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.

29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.

30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.

31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.

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33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.

34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.

35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer's review of the submittals.

36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.

38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.

39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.

40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.

41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers' instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.

42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion of such Work.

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43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.

44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.

45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.

46. *Technical Data*

    a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.

    b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.

    c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.

47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.

48. *Unit Price Work*—Work to be paid for on the basis of unit prices.

49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

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1.02 *Terminology*

A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.

C. *Day*: The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective*: The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:

1. does not conform to the Contract Documents;

2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

3. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).

E. *Furnish, Install, Perform, Provide*

1. The word "furnish," when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

2. The word "install," when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.

3. The words "perform" or "provide," when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.

4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words "furnish," "install," "perform," or "provide," then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

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F. *Contract Price or Contract Times*: References to a change in "Contract Price or Contract Times" or "Contract Times or Contract Price" or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term "or both" is not expressed.

G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).

B. *Evidence of Contractor's Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.

C. *Evidence of Owner's Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.

B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:

1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;

2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work

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into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.

B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.

1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.

3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.

4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.

B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.

C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

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ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.

B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.

C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.

D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.

E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.

F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

G. Nothing in the Contract Documents creates:

1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or

2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

A. *Standards Specifications, Codes, Laws and Regulations*

1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility

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inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements*: Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

2. *Contractor's Review of Contract Documents*: If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.

3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:

a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or

b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.

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B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.

C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

A. Contractor and its Subcontractors and Suppliers shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or

2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the

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established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.

1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.

2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.

B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.

B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.

C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:

1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;

2. Abnormal weather conditions;

3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.

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D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:

1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.

2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.

3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.

E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:

1. The circumstances that form the basis for the requested adjustment;

2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;

3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;

4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and

5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.

Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.

F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.

G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.

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B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.

C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas*

1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

B. *Removal of Debris During Performance of the Work*: During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.

C. *Cleaning*: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment

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and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

D. *Loading of Structures*: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;

2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and

3. Technical Data contained in such reports and drawings.

B. *Underground Facilities*: Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

C. *Reliance by Contractor on Technical Data*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.

D. *Limitations of Other Data and Documents*: Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;

3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

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5.04 *Differing Subsurface or Physical Conditions*

A. *Notice by Contractor*: If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:

1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;

2. is of such a nature as to require a change in the Drawings or Specifications;

3. differs materially from that shown or indicated in the Contract Documents; or

4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

B. *Engineer's Review*: After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.

C. *Owner's Statement to Contractor Regarding Site Condition*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.

D. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

E. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

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Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;

b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,

c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:

a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;

b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or

c. Contractor failed to give the written notice required by Paragraph 5.04.A.

3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.

F. *Underground Facilities; Hazardous Environmental Conditions*: Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

A. *Contractor's Responsibilities*: Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:

1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;

2. complying with applicable state and local utility damage prevention Laws and Regulations;

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3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;

4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and

5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.

B. *Notice by Contractor*: If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.

C. *Engineer's Review*: Engineer will:

1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;

2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;

3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and

4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.

During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

D. *Owner's Statement to Contractor Regarding Underground Facility*: After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.

E. *Early Resumption of Work*: If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.

F. *Possible Price and Times Adjustments*

1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

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or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;

b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and

c. Contractor gave the notice required in Paragraph 5.05.B.

2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.

3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.

4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings*: The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;

2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and

3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized*: Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

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of construction to be employed by Contractor, and safety precautions and programs incident thereto;

2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.

C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.

D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.

E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.

F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.

G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.

H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

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conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.

I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.

B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.

C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

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Regulations, and must be issued and signed by a surety named in "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.

D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.

E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.

F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner's termination rights under Article 16.

G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.

H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.

B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.

C. Alternative forms of insurance coverage, including but not limited to self-insurance and "Occupational Accident and Excess Employer's Indemnity Policies," are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.

D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

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Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.

E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.

F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.

G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.

H. Contractor shall require:

   1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and

   2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.

I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.

J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.

K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

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L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.

M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.

N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 *Contractor's Insurance*

A. *Required Insurance*: Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.

B. *General Provisions*: The policies of insurance required by this Paragraph 6.03 as supplemented must:

1. include at least the specific coverages required;

2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;

3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;

4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and

5. include all necessary endorsements to support the stated requirements.

C. *Additional Insureds*: The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:

1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;

2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;

3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

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4. not seek contribution from insurance maintained by the additional insured; and

5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.

B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.

C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.

D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.

E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

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Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.

1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.

B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.

1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.

C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.

D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

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6.06 *Receipt and Application of Property Insurance Proceeds*

A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.

B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.

C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.01 *Contractor's Means and Methods of Construction*

A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.

B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents.

B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

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B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.

C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.

B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

A. *Contractor's Request; Governing Criteria*: Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.

1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:

a. in the exercise of reasonable judgment Engineer determines that the proposed item:

1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

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2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;

3) has a proven record of performance and availability of responsive service; and

4) is not objectionable to Owner.

b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:

1) there will be no increase in cost to the Owner or increase in Contract Times; and

2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.

B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.

C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.

D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.

E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 *Substitutes*

A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.

1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.

2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

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3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:

    a. will certify that the proposed substitute item will:

        1) perform adequately the functions and achieve the results called for by the general design;

        2) be similar in substance to the item specified; and

        3) be suited to the same use as the item specified.

    b. will state:

        1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;

        2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

        3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.

    c. will identify:

        1) all variations of the proposed substitute item from the item specified; and

        2) available engineering, sales, maintenance, repair, and replacement services.

    d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.

B. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.

C. *Special Guarantee*: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

D. *Reimbursement of Engineer's Cost*: Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

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E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.

F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.

B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.

C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.

D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.

E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.

F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.

G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

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H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.

I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.

J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.

K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.

L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.

M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If an invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights will be disclosed in the Contract Documents.

B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

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7.09 *Permits*

A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

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7.13 *Safety and Protection*

A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.

B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.

C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:

1. all persons on the Site or who may be affected by the Work;

2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.

F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.

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I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).

J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:

a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;

b. determine and verify:

1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;

2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and

3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;

c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.

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3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.

B. *Submittal Procedures for Shop Drawings and Samples*: Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.

1. *Shop Drawings*

a. Contractor shall submit the number of copies required in the Specifications.

b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.

2. *Samples*

a. Contractor shall submit the number of Samples required in the Specifications.

b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.

3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Engineer's Review of Shop Drawings and Samples*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.

2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.

3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will

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document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.

5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.

6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.

7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.

8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.

D. *Resubmittal Procedures for Shop Drawings and Samples*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.

2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.

3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.

E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*

1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:

   a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.

   b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

   c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.

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d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.

2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03. 2.04, and 2.05.

F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.

B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:

1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and

2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.

C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

2. normal wear and tear under normal usage.

D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:

1. Observations by Engineer;

2. Recommendation by Engineer or payment by Owner of any progress or final payment;

3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;

4. Use or occupancy of the Work or any part thereof by Owner;

5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;

7. The end of the correction period established in Paragraph 15.08;

8. Any inspection, test, or approval by others; or

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9. Any correction of defective Work by Owner.

E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.

B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.

B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.

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D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.

E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:

1. Checking for conformance with the requirements of this Paragraph 7.19;

2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and

3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.

F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.

G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.

B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.

C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.

D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

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E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:

1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;

2. An itemization of the specific matters to be covered by such authority and responsibility; and

3. The extent of such authority and responsibilities.

B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.

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B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.

1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.

2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.

C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

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9.05 *Lands and Easements; Reports, Tests, and Drawings*

A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.

B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.

C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.

B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

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ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract.

10.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.

B. If Owner designates an individual or entity who is not Engineer's consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer's Authority*

A. Engineer has the authority to reject Work in accordance with Article 14.

B. Engineer's authority as to Submittals is set forth in Paragraph 7.16.

C. Engineer's authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner's delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.

D. Engineer's authority as to changes in the Work is set forth in Article 11.

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E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

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ARTICLE 11—CHANGES TO THE CONTRACT

11.01 *Amending and Supplementing the Contract*

A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.

B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.

C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

A. Owner and Contractor shall execute appropriate Change Orders covering:

1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;

2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;

3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and

4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.

B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

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B. If Owner has issued a Work Change Directive and:

1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.

2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.

B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.

B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.

C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.

B. An adjustment in the Contract Price will be determined as follows:

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1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).

C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
   1. A mutually acceptable fixed fee; or
   2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
      a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
      b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
      c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
      d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
      e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
      f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

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11.08 *Change of Contract Times*

A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.

B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

A. *Purpose and Content*: Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.

B. *Change Proposal Procedures*

1. *Submittal*: Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.

2. *Supporting Data*: The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.

    a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.

    b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

    The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

3. *Engineer's Initial Review*: Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.

4. *Engineer's Full Review and Action on the Change Proposal*: Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

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Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.

C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.

D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:

1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;

2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;

3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and

4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.

B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

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and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.

D. *Mediation*

1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.

2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.

3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.

E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.

F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.

G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:

1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

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2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.

B. *Costs Included*: Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.

2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.

3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.

4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.

5. Other costs consisting of the following:

   a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

   b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, which are

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consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.

c. *Construction Equipment Rental*

1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.

2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.

3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.

d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

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g. The cost of utilities, fuel, and sanitary facilities at the Site.

h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.

i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expediters, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.

2. The cost of purchasing, renting, or furnishing small tools and hand tools.

3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

5. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

6. Expenses incurred in preparing and advancing Claims.

7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:

a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.

b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:

1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.

2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.

2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

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Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

E. *Documentation and Audit*: Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 *Allowances*

A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.

B. *Cash Allowances*: Contractor agrees that:

1. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and

2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.

C. *Owner's Contingency Allowance*: Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 *Unit Price Work*

A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.

C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

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thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:

a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.

2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.

3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.

B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.

C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

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D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:

1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;

2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;

3. by manufacturers of equipment furnished under the Contract Documents;

4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and

5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.

F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

A. *Contractor's Obligation*: It is Contractor's obligation to assure that the Work is not defective.

B. *Engineer's Authority*: Engineer has the authority to determine whether Work is defective, and to reject defective Work.

C. *Notice of Defects*: Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.

D. *Correction, or Removal and Replacement*: Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.

E. *Preservation of Warranties*: When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

F. *Costs and Damages*: In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

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losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.

B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.

C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, and provide all necessary labor, material, and equipment.

1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.

2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then Owner may order Contractor to stop the Work,

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or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.

B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.

C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

A. *Basis for Progress Payments*: The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.

B. *Applications for Payments*

1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents.

2. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

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establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.

2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:

   a. the Work has progressed to the point indicated;

   b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and

   c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.

3. By recommending any such payment Engineer will not thereby be deemed to have represented that:

   a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or

   b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

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4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:

    a. to supervise, direct, or control the Work;

    b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;

    c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;

    d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or

    e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.

6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:

    a. the Work is defective, requiring correction or replacement;

    b. the Contract Price has been reduced by Change Orders;

    c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

    d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or

    e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.

D. *Payment Becomes Due*

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.

E. *Reductions in Payment by Owner*

1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:

    a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

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b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;

c. Contractor has failed to provide and maintain required bonds or insurance;

d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;

e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;

f. The Work is defective, requiring correction or replacement;

g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;

h. The Contract Price has been reduced by Change Orders;

i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;

j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;

k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or

l. Other items entitle Owner to a set-off against the amount recommended.

2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.

3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

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submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.

B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.

C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.

D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.

E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.

F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

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significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.

2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.

3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.

2. The final Application for Payment must be accompanied (except as previously delivered) by:

   a. all documentation called for in the Contract Documents;

   b. consent of the surety, if any, to final payment;

   c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

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d. a list of all duly pending Change Proposals and Claims; and

e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.

3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.

B. *Engineer's Review of Final Application and Recommendation of Payment*: If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. *Notice of Acceptability*: In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.

D. *Completion of Work*: The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.

E. *Final Payment Becomes Due*: Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

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appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. correct the defective repairs to the Site or such adjacent areas;
2. correct such defective Work;
3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.

B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.

C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.

D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.

E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

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F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:

1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment, or failure to adhere to the Progress Schedule);

2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;

3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or

4. Contractor's repeated disregard of the authority of Owner or Engineer.

B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:

1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and

2. enforce the rights available to Owner under any applicable performance bond.

C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and complete the Work as Owner may deem expedient.

D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.

E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

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attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.

G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and

3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.

B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.

B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

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provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

A. *Disputes Subject to Final Resolution*: The following disputed matters are subject to final resolution under the provisions of this article:

1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and

2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.

B. *Final Resolution of Disputes*: For any dispute subject to resolution under this article, Owner or Contractor may:

1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;

2. agree with the other party to submit the dispute to another dispute resolution process; or

3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:

1. in person, by a commercial courier service or otherwise, to the recipient's place of business;

2. by registered or certified mail, postage prepaid, to the recipient's place of business; or

3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

A. When any period of time is referred to in the Contract by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

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18.03 *Cumulative Remedies*

A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

18.04 *Limitation of Damages*

A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract.

18.09 *Successors and Assigns*

A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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EXHIBIT D

Supplementary Conditions

SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract as indicated below. The General Conditions remain in full force and effect except as amended or supplemented.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof. As used in the Contract Documents, masculine pronouns refer to both masculine and feminine genders.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added.

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

SC-1.01 Delete and replace the following subsections in Paragraph 1.01.A:

5. *Bidder*: Any individual, partnership, corporation, joint venture, or other legal entity who submits a Bid to Owner for the Work contemplated and meets the standards set forth in Oregon Revised Statutes 279B.110.

16. *Contractor*: Person or entity identified as such in the Agreement and the Contractor's authorized representatives who are referred to throughout the Contract Documents as if singular in number.

22. *Engineer*: Person or entity identified as such in the Agreement and the Engineer's authorized representatives who are referred to throughout the Contract Documents as if singular in number.

30. *Owner*: The individual, entity, public body or authority identified as such in the Agreement and the Owner's authorized representatives who are referred to throughout the Contract Documents as if singular in number.

SC-1.01 Revise Paragraph 1.01.A.33 by replacing the word "Engineer" with "Owner" and adding the sentence "Synonymous with Construction Manager." to the end of the paragraph.

SC-1.01 Add the following language at the end of 1.01.A.42:

Substantial Completion is further defined as (i) that degree of completion of the Project's operating facilities or systems sufficient to provide Owner the full time, uninterrupted, and continuous beneficial operation of the Work; (ii) all required functional, performance, and acceptance or startup testing has been successfully demonstrated for all components, devices, equipment, and instrumentation and control to the satisfaction of Engineer in accordance with the requirements of the Specifications; (iii) all inspections required have been completed and identified critical defective Work has been replaced or corrected; and (iv) all appurtenant operations and maintenance features (i.e., hose bibs, drainage systems,

etc.) have been installed and are functional. See Paragraph SC-15.03.A for additional requirements.

SC-1.01 Add the following language to the end of the sentence in Paragraph 1.01.A.44:

"as further identified in the Agreement."

SC-1.01 Add new paragraphs immediately following Paragraph 1.01.A.50:

51. *Latent Defect*: A defect in the Work of which the Owner has no knowledge.

52. *Specialist*: The term Specialist refers to a person, partnership, firm, or corporation of established reputation (or if newly organized, whose personnel have previously established a reputation in the same field), which is regularly engaged in, and which maintains a regular force of workers skilled in either (as applicable) manufacturing of fabricated items required by the Contract Documents, or otherwise performing Work required by the Contract Documents. Where the Specifications require the installation by a Specialist, that term shall also be deemed to mean either the manufacturer of the items, a person, partnership, firm, or corporation licensed by the manufacturer, or a person, partnership, firm, or corporation who will perform the Work under the manufacturer's direct supervision.

53. *Construction Manager*: Person or entity designated by the Owner to provide construction management services for the Project with duties, responsibilities, and limitations of the Engineer, unless stipulated otherwise. Synonymous with and having same meaning as Resident Project Representative.

54. *Equipment*:

    a) Construction: All machinery and equipment, together with the necessary supplies for upkeep and maintenance, including tools and apparatus necessary for the proper construction and acceptable completion of the Work contemplated.

    b) Installation: All material or articles used in equipping a facility or apparatus required to fulfill a functional design.

55. *Geotechnical Data Report ("GDR")*: The factual report that collects and presents data regarding actual subsurface conditions at or adjacent to the Site, including Technical Data and other geotechnical data, prepared by or for Owner. The GDR's content may include logs of borings, trenches, and other site investigations, recorded measurements of subsurface water levels, the results of field and laboratory testing, and descriptions of the investigative and testing programs. The GDR does not include an interpretation of the data. If opinions, or interpretive or speculative non-factual comments or statements appear in a document that is labeled a GDR, such opinions,

comments, or statements are not operative parts of the GDR and do not have contractual standing. Subject to that exception, the GDR is a Contract Document.

56. *ORS*: Oregon Revised Statutes.

57. *OAR*: Oregon Administrative Rules.

58. *Float*: The number of days an activity can be delayed beyond its scheduled completion without delaying a succeeding or related activity or restricting the schedule of a preceding activity in the construction schedule.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01 Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.

C. *Public Works Bond:* Before starting any work on the Project, Contractor and every Subcontractor performing work on the Project must have a public works bond filed with the Oregon Construction Contractors Board, as required by ORS 279C.830 and 279C.836, unless exempt under those provisions. Contractor must require that the Subcontractor have a public works bond filed with the Construction Contractors Board before starting work on the Project unless exempt under ORS 279C.836. Contractor shall include copies of both its public works bond and the public works bonds from its Subcontractors in the copies of the bonds required in Paragraph 2.01.A above. See SC-6.01.A for additional requirements related to the public works bond.

2.02 *Copies of Documents*

SC-2.02 Delete the first sentence of Paragraph 2.02.A in its entirety and replace with the following:

If requested, Owner shall furnish to Contractor up to four copies of the conformed Contract Documents (Specifications and half size Drawings and two copies of full-size Drawings) incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully executed counterpart of the Agreement) and one copy in electronic portable document format (PDF).

2.03 *Before Starting Construction*

SC-2.03 Add new paragraph immediately following Paragraph 2.03.A.3:

4. a preliminary schedule of payments showing projected cash flow.

SC-2.03 Add new paragraphs immediately following Paragraph 2.03.A:

B. Before any Work at the Site is started, Contractor shall prepare and submit a written plan for the Project-specific safety precautions and programs. The safety plan shall identify Contractor's process for ensuring that safety is the highest priority on the Project and will be

complete with respect to procedures and actions that Contractor intends for Contractor and all others as provided in Paragraphs 7.13 and as required by all applicable Laws and Regulations. The submittal shall include a statement that the Contractor is solely responsible for safety on the Project, that it will conduct its operations in accordance with all applicable safety standards and requirements, and that it will continually review its operations to ensure that safe conditions are provided at all times. Contractor's plan for safety precautions and programs shall have been approved and endorsed by Contractor's designated safety representative required in Paragraph 7.13.B. Delivery of this plan will in no way reduce or obviate Contractor's obligation to comply with the safety obligations set forth in Section 7.13 of the General Conditions.

C. *Contractor Drug Testing Program*: Before any Work at the site is started, Contractor shall provide evidence that it has an employee drug testing program in place that is administered and enforced by the Contractor in accordance with ORS 279C.505.

D. Before any Work at the Site is started, Contractor shall prepare and submit a plan describing their Workplace Harassment Prevention Program. The program shall ensure all workers, regardless of their identity or status, are guaranteed a safe and respectful work environment. This applies, but is not limited to, a worker's race, ethnicity, color, national origin, gender identity, gender expression, sex, sexual orientation, religion, marital or familial status, age, mental or physical disability (as defined by the American's with Disabilities Act and Oregon state law), former incarceration, immigrant status, or veteran status.

   1. The program shall include in-person/virtual training for workers of all ranks and meaningful policies including procedures for aggrieved workers in need of recourse.

   2. Contractor shall post on the jobsite and make available a notice that rights of workers on the site include:

      a. Participation in positive jobsite training.

      b. Copies of policies about hate, intimidation or harassment including how to report and how to receive support. Contractor must provide these materials in languages inclusive of the workforce.

      c. Contractor shall investigate incidents involving bullying or harassment in a prompt, thorough, and impartial manner.

E. Contractor shall assume responsibility for every aspect of providing a safe and respectful workplace on the jobsite, including a safe and respectful workplace for and by Subcontractors, suppliers and other persons on the jobsite.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

SC-2.04 Add the following to the end of Paragraph 2.04.A:

The preconstruction conference will be scheduled by Contractor within five (5) days of the Notice to Proceed or as otherwise agreed to by the parties.

2.05 *Acceptance of Schedules*

SC-2.05 Add the following to the end of Paragraph 2.05.A:

5. Contractor's schedule of payments will be acceptable if it provides a reasonable projection of payments in relationship to the Progress Schedule and Schedule of Values.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

SC 3.01 Add the following to the end of Paragraph 3.01.A:

However, in the event of conflicts or discrepancies among the Contract Documents, interpretations will be based on the following descending order of precedence:

1. Permits from outside agencies;
2. Amendments to the Contract Documents and addenda, with those of later date having precedence over those of an earlier date;
3. The Agreement including all exhibits;
4. Supplementary General Conditions;
5. Standard General Conditions of the Construction Contract, Engineers Joint Contract Documents Committee (EJCDC) 2018;
6. Specifications – Division 01;
7. Specifications – Divisions 02 - 49;
8. Drawings;
9. Design Details: Figure dimensions, and dimensions that can be computed, on plans shall take precedence over scale dimensions. The Drawings with the higher level of detail take precedence over less detailed Drawings.

Change Orders, Work Change Directives, Field Orders, Engineer's written interpretation and clarifications and Notice to Proceed, in precedence listed, will take precedence over all other Contract Document components referenced herein.

SC 3.01 Add the following paragraph immediately after Paragraph 3.01.G:

H. Sections of Division 01, General Requirements, govern the execution of the Work of all sections of the Specifications.

3.03 *Reporting and Resolving Discrepancies*

SC 3.03 Delete Paragraph 3.03.B.1 in its entirety and replace with the following:

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and the provision of any standard specification, manual, reference standard, or code,

or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document).

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

SC 4.01 Delete the third sentence of Paragraph 4.01.A in its entirety.

4.04 *Progress Schedule*

SC 4.04 Add the following subparagraph immediately after Paragraph 4.04.A.2:

3. If, in the opinion of Engineer, Contractor falls behind the accepted Construction Schedule due to actions or neglect of Contractor or Contractor's agents, servants, employees, officers, Subcontractors, directors, or any party contracting to perform part or all of the Work or to supply any equipment or materials, Contractor shall take steps, including, but not limited to, increasing the number of personnel, shifts, and/or overtime operations, days of work, and/or amount of construction equipment until such time as the Work is back on schedule. Contractor shall also submit for review no later than the time of submittal of the next request for partial payment, such supplementary schedule or schedules as may be necessary to demonstrate the manner in which the acceptable rate of progress will be regained, all without additional cost to Owner.

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.01 *Availability of Lands*

SC 5.01 Delete Paragraph 5.01.B in its entirety.

SC 5.01 Add the following paragraph immediately after Paragraph 5.01.c:

D. Any work performed in public rights-of-way, in addition to conforming to the Contract Documents, shall be done in accordance with the requirements of the permit issued by the public agency in whose right-of-way the Work is located.

5.02 *Use of Site and Other Areas*

SC 5.02 Delete subparagraph 5.02.A.2 in its entirety and replace with the following:

2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claims as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or at law; and (c) to the fullest extent permitted by Laws and Regulations, indemnify Owner, Clackamas County and their officers, elected officials, directors, employees, agents, consultants, and subcontractors from and against any such claim, and against all costs (including attorney fees), losses and damages arising out of or relating to any claim or action, legal or equitable, brought by any such owner

or occupant against Owner or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor has a right to control. For any settlement in which the Design-Builder may seek to recover any costs or attribute any costs to the Owner, the Design-Builder shall give the Owner the opportunity to review and approve the terms of the settlement prior to Design-Builder entering an agreement with any party. Design-Builder's failure to provide Owner the opportunity to review the terms of a settlement prior to execution of a settlement agreement shall bar the Design-Builder from seeking to recover any costs associated with the settlement from the Owner.

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

E. The following table lists the reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data, and specifically identifies the Technical Data in the report upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None known to Owner		

F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None known to Owner		

G. Contractor may request copies from Engineer of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. The following table lists the reports known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and the Technical Data (if any) upon which Contractor may rely:

Report Title	Date of Report	Technical Data
None known to Owner		

5. The following table lists the drawings known to Owner relating to Hazardous Environmental Conditions at or adjacent to the Site, and Technical Data (if any) contained in such Drawings upon which Contractor may rely:

Drawings Title	Date of Drawings	Technical Data
None known to Owner		

SC-5.06 Delete Paragraph 5.06.I and 506.J in their entirety and replace with the following:

I. Subject to the limitations of the Oregon Constitution and the Oregon Tort Claims Act, Owner shall indemnify Contractor, and its officers, employees, and agents from and against all claims, costs losses and damages arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work; and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify Owner and Clackamas County and their officers, elected officials, directors, employees, agents, consultants, and subcontractors from and against all claims, costs (including attorney fees), losses, and damages arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

SC-6.01 Add the following paragraphs immediately after Paragraph 6.01.C:

The Contractor will submit the performance bond and payment bond on forms provided by the Owner.

SC-6.01 Delete Paragraph 6.01.B in its entirety and replace with the following:

B. Before starting any work on the Project, the Contractor shall file with the Oregon Construction Contractors Board, and maintain in full force and effect, the separate public works bond required by Oregon Revised Statutes, Chapter 279C.830 and 279C.836, unless otherwise exempt under those provisions. The Contractor shall also include in every subcontract a provision requiring the Subcontractor to have a public works bond filed with the Construction Contractors Board before starting Work, unless otherwise exempt, and shall verify that the Subcontractor has filed a public works bond before permitting any Subcontractor to start Work. Contractor shall include copies of both its public works bond

and the public works bonds from its Subcontractors in the copies of the bonds required in Paragraph 2.01.A above.

These bonds shall remain in effect until one year after date of final completion of the Project and acceptance by the Owner, except as provided otherwise by Laws or Regulations or by the Contract Documents.

SC-6.01 Add the following phrase to Paragraph 6.01.C after the word "Treasury":

or otherwise acceptable to Owner.

SC-6.01 Add the following sentence to the end of Paragraph 6.01.C:

The performance bond shall include, in part, provisions to indemnify Owner, and its officers, directors, elected officials, agents, and employees.

6.02 *Insurance—General Provisions*

SC-6.02 Delete paragraph 6.02.B. in its entirety and replace with the following:

B. As evidence of the insurance coverage required by the Contract, the Contractor shall furnish certificate(s) of insurance to the Owner prior to execution of the Agreement. The certificate(s) will specify all of the parties who are additional insureds or loss payees for the Agreement, identified in SC-6.02.C. A renewal certificate shall be sent to Owner at least 10 days prior to coverage expiration.

Insurance coverage required under the Agreement shall be obtained from insurance companies or entities acceptable to the Owner and that are eligible to provide such insurance under Oregon law. Eligible insurers include admitted insurers that have been issued a certificate of authority from the Oregon Department of Consumer and Business Services authorizing them to conduct an insurance business and issue policies of insurance in the state of Oregon, and certain non-admitted surplus lines insurers that satisfy the requirements of applicable Oregon law and which are subject to approval by the Owner. All companies that provide policies required under this Contract shall have a rating of not less than A-X in the most current edition of Best's Rating Guide, in addition to any other requirements specified herein. The Contractor shall be financially responsible for all deductibles, self-insured retentions and/or self-insurance included hereunder. Any deductible, self-insured retention and/or self-insurance in excess of $50,000 shall be subject to approval by the Owner in writing and shall be a condition precedent to the effectiveness of any Contract.

SC-6.02 Add the following to the end of Paragraph 6.02.D:

The general liability insurance coverage, automobile liability, umbrella, and pollution liability if required, shall include the Owner (Water Environment Services), Clackamas County and Engineer (Jacobs Engineering Group, Inc.) as additional insureds, but only with respect to the Contractor's activities to be performed under the Contract Documents. The additional-insured endorsement for CGL insurance must be written on ISO Form CG 20 10 (10 01) and CG 20 37 (10 01), or their equivalent, but shall not use either of the following forms: CG 20 10 (10 93) or CG 20 10 (03 94). Proof of insurance must include a copy of the

endorsement showing “Water Environment Services and Clackamas County, together with their elected officials, agents, officers, and employees” as scheduled insureds.

If Contractor cannot obtain an insurer to name the Owner and Engineer as additional insureds, Contractor shall obtain at Contractor's expense, and keep in effect during the term of the Contract, Owners and Contractors Protective Liability Insurance, naming the Owner and Engineer as additional insureds with not less than a $4,000,000 limit per occurrence. This policy must be kept in effect for 36 months following final completion. As evidence of coverage, Contractor shall furnish the actual policy to Owner prior to execution of the Agreement.

SC-6.02 Delete all language in Paragraphs 6.02.E, I, and K and replace each with the word “Reserved.”

SC-6.02 Delete from Paragraph 6.02.N “10 days” and replace with “60 days”

SC-6.02 Add the following new paragraphs in order after Paragraph 6.02.N.

O. Compliance. Failure of the Contractor to fully comply with these requirements will be considered a material breach of Contract and shall be cause for immediate termination of the Contract at the option of Owner.

P. If the Contractor receives a non-renewal or cancellation notice from an insurance carrier affording coverage required herein, or receives notice that coverage no longer complies with the insurance requirements herein, Contractor agrees to notify Owner within five (5) business days with a copy of the non-renewal or cancellation notice, or written specifics as to which coverage is no longer in compliance. When notified by Owner, the Contractor agrees to stop Work pursuant to the Contract at Contractor’s expense, unless all required insurance remain in effect. Any failure to comply with the reporting provisions of this section, except for the potential exhaustion of aggregate limits, shall not affect the coverages provided to the Owner and its institutions, divisions, officers, and employees. Owner shall have the right, but not the obligation, of prohibiting Contractor from entering the Project Site until a new certificate(s) of insurance is provided to Owner evidencing the replacement coverage. The Contractor agrees that Owner reserves the right to withhold payment to Contractor until evidence of reinstated or replacement coverage is provided to Owner.

Q. Upon Owner’s approval, Contractor may obtain worker’s compensation insurance from an insurance company that has not been rated by A.M. Best, provided that such company (a) is domiciled in the state in which the project is located, (b) is certified or authorized as a worker’s compensation insurance provider by the appropriate state agency, and (c) has been accepted to provide worker’s compensation insurance for similar projects by the state within the last 12 months.

R. All insurance carried by Contractor under the Agreement shall be the primary coverage. The coverages indicated are minimums unless otherwise specified in the Contract Documents.

6.03 *Contractor’s Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess,

pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following: None.

E. *Workers' Compensation and Employer's Liability:* The Contractor is an independent contractor for purposes of the Oregon Workers' Compensation Law, as set forth in ORS Chapter 656 ("Workers' Comp Law") and is solely liable for any Workers' Compensation coverage under this Agreement. All employers, including Contractor, that employ subject workers who work under the Agreement in the State of Oregon shall comply with ORS 656.017 and provide the required Workers' Compensation coverage, unless such employers are exempt under ORS 656.126. This shall include Employer's Liability Insurance with coverage limits of not less than $500,000 per accident for bodily injury or disease. Contractor shall ensure that each of its Subcontractors complies with these requirements. The Contractor shall require proof of such Workers' Compensation coverage by receiving and keeping on file a certificate of insurance from each Subcontractor or anyone else directly employed by either the Contractor or its Subcontractors. The Contractor will be solely responsible for payment of any local, state or federal taxes required as a result of these Contract Documents.

Workers' Compensation and Related Policies	**Policy limits of not less than:**
Workers' Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman's)	Statutory
Foreign voluntary workers' compensation (employer's responsibility coverage), if applicable	Statutory
Employer's Liability	
Each accident	$500,000

These Contract Documents are not intended to entitle the Contractor to any benefits generally granted to the District, officers, commissioners, agents or employees. Without limitation, but by way of illustration, the benefits not intended to be extended to the Contractor are vacation, holiday and sick leave, other leaves with pay, tenure, medical and dental coverage, life and disability insurance, overtime pay, Social Security, workers' compensation, unemployment compensation, or retirement benefits (except so far as benefits are required by law if the Contractor is presently a member of the Public Employees Retirement System).

F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:

1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees,
2. damages insured by reasonably available personal injury liability coverage, and
3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.

G. *Commercial General Liability—Form and Content:* Contractor's commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial

general liability form (occurrence form) and include the following coverages and endorsements:

1. Products and completed operations coverage.
    a. Such insurance must be maintained for three years after final payment.
    b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
2. Blanket contractual liability coverage, including but not limited to coverage of Contractor's contractual indemnity obligations in Paragraph 7.18.
3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
4. Underground, explosion, and collapse coverage.
5. Personal injury coverage.
6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.
7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 "Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured" or its equivalent.

H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:

1. Any modification of the standard definition of "insured contract" (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
2. Any exclusion for water intrusion or water damage.
3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
4. Any exclusion of coverage relating to earth subsidence or movement.
5. Any exclusion for the insured's vicarious liability, strict liability, or statutory liability (other than worker's compensation).
6. Any limitation or exclusion based on the nature of Contractor's work.
7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.

I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	**Policy limits of not less than:**
General Aggregate	$ 5,000,000

Commercial General Liability	Policy limits of not less than:
Products—Completed Operations Aggregate	$ 2,000,000
Personal and Advertising Injury	$ 1,000,000
Bodily Injury and Property Damage—Each Occurrence	$ 4,000,000

J. *Automobile Liability:* Contractor shall obtain, at Contractor's expense, and keep in effect during the term of the Agreement, Automobile Liability Insurance covering owned, and/or hired vehicles, as applicable. The coverage may be written in combination with the Commercial General Liability Insurance. Contractor and its Subcontractors shall be responsible for ensuring that all non-owned vehicles maintain adequate Automobile Liability insurance while on Project Site. The Owner may adjust the Automobile Liability insurance amounts required under this provision at any time based upon institution specific risk assessments through the issuance of an amendment to the Agreement.

Automobile Liability	Policy limits of not less than:
Combined Single Limit	
Combined Single Limit (Bodily Injury and Property Damage)	$ 2,000,000

K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	$ 10,000,000
General Aggregate	$ 10,000,000

L. *Using Umbrella or Excess Liability Insurance to Meet CGL and Other Policy Limit Requirements:* Contractor may meet the policy limits specified for employer's liability, commercial general liability, and automobile liability through the primary policies alone, or through combinations of the primary insurance policy's policy limits and partial attribution of the policy limits of an umbrella or excess liability policy that is at least as broad in coverage as that of the underlying policy, as specified herein. If such umbrella or excess liability policy was required under this Contract, at a specified minimum policy limit, such umbrella or excess policy must retain a minimum limit of $3,000,000 after accounting for partial attribution of its limits to underlying policies, as allowed above.

M. *Contractor's Pollution Liability Insurance:* Contractor shall purchase and maintain a policy covering third-party injury and property damage, including cleanup costs, as a result of pollution conditions arising from Contractor's operations and completed operations. This insurance must be maintained for no less than three years after final completion.

Contractor's Pollution Liability	Policy limits of not less than:
Each Occurrence/Claim	$ 5,000,000

Contractor's Pollution Liability	Policy limits of not less than:
General Aggregate	$ 10,000,000

N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	$ 1,000,000
Annual Aggregate	$ 5,000,000

6.04 *Builder's Risk and Other Property Insurance*

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

F. *Builder's Risk Requirements:* The builder's risk insurance must:

1. be written on a builder's risk "all risk" policy form that at a minimum includes insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment stored and in transit, and must not exclude the coverage of the following risks: fire; windstorm; hail; flood; earthquake, volcanic activity, and other earth movement; lightning; riot; civil commotion; terrorism; vehicle impact; aircraft; smoke; theft; vandalism and malicious mischief; mechanical breakdown, boiler explosion, and artificially generated electric current; collapse; explosion; debris removal; demolition occasioned by enforcement of Laws and Regulations; and water damage (other than that caused by flood).

    a. Such policy will include an exception that results in coverage for ensuing losses from physical damage or loss with respect to any defective workmanship, methods, design, or materials exclusions.

    b. If insurance against mechanical breakdown, boiler explosion, and artificially generated electric current; earthquake, volcanic activity, and other earth movement; or flood, are not commercially available under builder's risk policies, by endorsement or otherwise, such insurance will be provided through other insurance policies acceptable to Owner and Contractor.

2. cover, as insured property, at least the following: (a) the Work and all materials, supplies, machinery, apparatus, equipment, fixtures, and other property of a similar nature that are to be incorporated into or used in the preparation, fabrication, construction, erection, or completion of the Work, including Owner-furnished or assigned property; (b) spare parts inventory required within the scope of the Contract; and (c) temporary works which are not intended to form part of the permanent constructed Work but which are intended to provide working access to the Site, or to

the Work under construction, or which are intended to provide temporary support for the Work under construction, including scaffolding, form work, fences, shoring, falsework, and temporary structures.

3. cover expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of contractors, engineers, and architects).

4. extend to cover damage or loss to insured property while in temporary storage at the Site or in a storage location outside the Site (but not including property stored at the premises of a manufacturer or Supplier). If this coverage is subject to a sublimit, such sublimit will be a minimum of $100,000.

5. extend to cover damage or loss to insured property while in transit. If this coverage is subject to a sublimit, such sublimit will be a minimum of $100,000.

6. allow for the waiver of the insurer's subrogation rights, as set forth in this Contract.

7. allow for partial occupancy or use by Owner by endorsement, and without cancellation or lapse of coverage.

8. include performance/hot testing and start-up, if applicable.

9. include as named insureds the Owner, Contractor, Subcontractors (of every tier), and any other individuals or entities required by this Contract to be insured under such builder's risk policy. For purposes of Paragraphs 6.04, 6.05, and 6.06 of the General Conditions, and this and all other corresponding Supplementary Conditions, the parties required to be insured will be referred to collectively as "insureds."

SC-6.04 Supplement Paragraph 6.04 of the General Conditions with the following provisions:

G. *Coverage for Completion Delays:* The builder's risk policy will include, for the benefit of Owner, loss of revenue and soft cost coverage for losses arising from delays in completion that result from covered physical losses or damage. Such coverage will include, without limitation, fixed expenses and debt service for a minimum of 12 months with a maximum deductible of 30 days, plus engineering or other consultants' fees, if not otherwise covered.

H. *Builder's Risk and Other Property Insurance Deductibles:* The purchaser of any required builder's risk, installation floater, or other property insurance will be responsible for costs not covered because of the application of a policy deductible.

1. The builder's risk policy (or if applicable the installation floater) will be subject to a deductible amount of no more than $50,000 for direct physical loss in any one occurrence, except the earthquake and flood deductible, which shall not exceed 2 percent of each loss or $50,000, whichever is greater.

I. A loss insured under the Builder's Risk insurance shall be made payable to the Owner as loss payee. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-Subcontractors in similar manner. The Owner shall have power to work directly with and settle a loss with insurers.

6.05 *Property Losses; Subrogation*

SC-6.05 Delete all language in Paragraphs 6.05.B and C and replace each with the word "Reserved."

6.06 *Receipt and Application of Property Insurance Proceeds*

SC-6.06 Delete Paragraph 6.06.A, B and C in their entirety and replace with the following paragraph:

A. Any insured loss under the builder's risk and other policies of insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.02 *Supervision and Superintendence*

SC-7.02 Add the following immediately after the first sentence of Paragraph 7.02.B:

If a replacement is necessary, the replacement shall also be a competent resident superintendent and shall be subject to prior approval by Owner. The Contractor's superintendent shall be present at the Site at all times while Work is in progress and shall be available by phone for emergencies 24 hours per day, 7 days per week. If at any time the superintendent leaves the Project Site while Work is in progress, Owner and Engineer shall be notified and provided with the name of the Contractor's representative having responsible charge. The superintendent will be Contractor's representative at the Site and shall have authority to act on behalf of Contractor. All communications given to or received from the superintendent shall be binding on Contractor.

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

1. Regular working hours will be between 7:00 a.m. and 6:00 p.m. on weekdays, Monday through Friday, only. If change to these standard hours is desired, a written request must be placed with Owner and Engineer a minimum of five work days prior to the first day of altered hours. Contractor shall comply with all applicable requirements of ORS 279C.540.

2. The Contractor agrees to ensure observance of holidays in accordance with ORS 279C.540. Owner's legal holidays are:

    - New Year's Day (January 1)
    - Martin Luther King Jr. Day (third Monday in January)
    - President's Day (third Monday in February)
    - Memorial Day (last Monday in May)
    - Juneteenth National Independence Day (June 19)
    - Independence Day (July 4)
    - Labor Day (first Monday in September)
    - Veteran's Day (November 11)
    - Thanksgiving Day (fourth Thursday in November)
    - Christmas Day (December 25)

7.04 *Services, Materials, and Equipment*

SC-7.04 Add the following paragraphs immediately after Paragraph 7.04.C:

D. Until Substantial Completion of the Work is acknowledged by Owner, Contractor shall have the responsible charge and care of the Work and of materials to be used herein, including materials for which Contractor has received partial payment or materials which have been furnished by Owner, and shall bear the risk of injury, loss, or damage to any part thereof by the action of the elements or from any other cause, whether arising from the execution of the Work or not.

E. Contractor shall rebuild, repair, restore, and make good all injuries, losses, or damages to any portion of the Work or the materials occasioned by any cause before the Work's completion and acceptance and shall bear the expense thereof. Where necessary to protect the Work or materials from damage, Contractor shall, at Contractor's own expense, provide suitable drainage and erect such temporary structures or rent such structures as are necessary to protect the Work or materials from damage. The suspension of the Work or the granting of an extension of time for any cause whatever shall not relieve Contractor of Contractor's responsibility for the Work and materials as specified herein.

F. When the quality of a material, process, or article is not specifically set forth in the Contract Documents, the best available quality of the material, process, or article shall be provided.

7.06 *Substitutes*

SC-7.06 Amend Paragraph 7.06.B by deleting the third sentence stating "Engineer will be the sole judge of acceptability."

7.07 *Concerning Subcontractors and Suppliers*

SC-7.07 Add the following language directly following the last sentence of Paragraph 7.06.A:

Contractor shall perform with Contractor's own organization Work amounting to not less than 25 percent of the combined value of all items of the Work covered by the Contract.

SC-7.07 Add the following new paragraphs immediately after Paragraph 7.07.M:

N. Contractor shall ensure that any person entering into any subcontract to perform under the Contract is registered with the Secretary of State to do business in the State of Oregon, not prohibited from entering into a public contract by the Oregon Bureau of Labor and Industry, the Oregon Construction Contractors Board or Federal Excluded Party listings and is a Responsible Proposer as defined by ORS 279C.

O. Subcontractor Insurance: Unless a special type of insurance or special amount of coverage is required by the Owner for a specific subcontract or type of work, Contractor shall require all Subcontractors to provide and maintain insurance coverages with at least $1,000,000/claim, $2,000,000 aggregate for commercial general liability, $500,000/claim for automobile liability, $1,000,000/claim for professional liability (if applicable), and statutory limits for workers' compensation insurance. Contractor shall require certificates of insurance from all Subcontractors as evidence of coverage. Contractor shall provide copies of Subcontractor's certificates of insurance, if requested by Owner. This condition may be met through utilization of a Contractor Controlled Insurance Program.

7.08 *Patent Fees and Royalties*

SC-7.08 Delete Paragraph 7.08.B and .C in their entirety and replace with the following:

B. Subject to the limits of the Oregon Constitution, Owner shall indemnify Contractor, and its officers, employees, agents from and against all claims, costs (including attorney fees), losses, and damages arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.

C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify Owner, Clackamas County and their officers, directors, elected officials, employees, agents, consultants and subcontractors of from and against all claims, costs (including attorney fees), losses, and damages arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

7.09 *Permits*

SC-7.09 Add the following new paragraph immediately after Paragraph 7.09.A:

B. Contractor will be responsible for obtaining all required permits and maintaining compliance with those permits throughout the course of the Work. Owner will pay the cost of obtaining all permits. The Contractor shall be responsible for any penalties or fines that result from Contractor's noncompliance with the terms of the permits.

7.11 *Laws and Regulations*

SC-7.11 Delete Paragraph 7.11.B in its entirety and replace with the following:

B. If Contractor performs any Work or takes any other action knowing or having reason to know that is contrary to Laws and Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify Owner, Clackamas County, and their officers, directors, elected officials, employees, agents, consultants and subcontractors from and against all claims, costs, losses and damages (including attorneys fees) arising out of or relating to such Work or other action. It is not be Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.

SC-7.11 Add the following new paragraph immediately after Paragraph 7.11.C:

D. While not intended to be inclusive of all Laws or Regulations for which Contractor may be responsible under Paragraph 7.10, the following Laws or Regulations, as may be amended from time to time, are included as mandated by statute or for the convenience of Contractor:

1. Prevailing Wage Rates:

a. Contractor shall comply fully with the provisions of ORS 279C.800 through 279C.870. Pursuant to ORS 279C.830(1)(d), Contractor shall pay workers not less than the specified minimum hourly rate of wage, and shall include that requirements in all subcontracts.

PREVAILING WAGE RATES for Public Works Contracts in Oregon, July 1, 2022, which can be downloaded at the following web address:

http://www.oregon.gov/boli/whd/pwr/pages/pwr_state.aspx

b. Owner will pay the Commissioner of the Bureau of Labor and Industries the fee required by ORS 279C.825.

c. Contractor shall provide written notice to all workers of the number of hours per day and days per week such workers may be required to work.

2. Discrimination: Contractor shall comply with all applicable requirements of federal and state civil rights and rehabilitation statutes, rules and regulations, and:

   a. In accordance with ORS 279A.110, Contractor will not discriminate against Disadvantaged, Minority, Women, or Emerging Small Business enterprises, as those terms are defined in ORS 200.005, or a business enterprise that is owned or controlled by or that employs a disabled veteran, as that term is defined in ORS 408.225, in obtaining required subcontracts.

   b. Contractor shall maintain, in current and valid form, all licenses and certificates required by the applicable Laws, Regulations or the Contract when performing the work.

3. In accordance with ORS 279C.505, Contractor shall demonstrate to Owner that it has an employee drug testing program is in place prior to commencement and at all times during the performance of the Work.

4. ORS 654.150 applies at the Construction Site. All costs incurred in complying with state statutes requiring sanitation facilities shall be borne by Contractor.

5. Payment by Contractor:

   a. The Contractor shall promptly make full payment for labor, materials, supplies and provisions at such times as they become due and payable to all persons supplying the Contractor or their Subcontractor with labor, services, materials, supplies, or provisions for the prosecution of the Work provided for in the Contract. Contractor shall pay all contributions or amounts due the Industrial Accident Fund from such Contractor or Subcontractor incurred in the performance of the Work. The Contractor shall not permit any lien or claim to be filed or prosecuted against the Owner for or on account of any labor, services, materials, supplies, or provisions furnished. The Contractor shall pay to the Department of Revenue all sums withheld from employees pursuant to ORS 316.167.

   b. In the event the Contractor fails, neglects, or refuses to make prompt and full payment of any claim for labor, services, materials, supplies or provisions furnished by any person in connection with the Work, whether the labor, services, materials, supplies, or provisions to be performed are furnished for the Contractor or for a Subcontractor, then and in such event, the Owner may withhold the amount of such claim by the person or persons furnishing such labor, services, materials, supplies, or provisions and deduct the amount of from funds due or to become due to the Contractor by reason of the Contract Documents. The deduction of any such amounts because of claims and the manner herein authorized will not, however, relieve the Contractor or his surety from their obligation with respect to any unpaid

claims. Sums withheld for the purposes named herein will be paid to the Contractor upon certification that said claims have been paid. Notwithstanding the foregoing, Owner, in its discretion, may pay such claims and deduct or charge that amount of the payment against funds due or to become due the Contractor by reason of the Contract Documents.

c. If the Contractor or a first-tier Subcontractor fails, neglects or refuses to make payment to a party furnishing labor or materials in connection with the project within 30 days after receipt of payment from the Owner or Contractor, the Contractor or first-tier Subcontractor shall owe the party the amount due plus interest charges commencing at the end of the ten-day period that payment is due under ORS 279C.580(4) and any upon final payment unless payment is subject to a good-faith dispute as defined in ORS 279C.580. The rate of interest charge to the Contractor or first-tier Subcontractor and the amount due shall equal three times the discount rate on 90-day commercial paper in effect at the Federal Reserve Bank in the Federal Reserve District that includes Oregon on the date that is 30 days after the date when payment was received from the Owner or from the Contractor, but the rate of interest shall not exceed 30 percent. The amount of interest may not be waived. Contractor shall incorporate this provision into all subcontracts.

d. If the Contractor or a Subcontractor fails, neglects or refuses to make payment to a person furnishing labor or materials in connection with the Contract, the person may file a complaint with the Oregon Construction Contractor's Board unless payment is subject to a good-faith dispute as defined in ORS 279C.580. Resolution of such dispute and computation of amounts due plus interest and costs shall be as provided in that statute. Contractor shall incorporate this provision into any subcontract related to this project.

e. The payment of a claim in the manner authorized under this section shall not relieve the Contractor or the surety from any obligation with respect to any unpaid claims.

f. Contractor shall pay Subcontractor for satisfactory performance within ten days out of such amounts paid to Contractor by Owner, and shall at all times comply with ORS 279C.580, which is incorporated herein by reference.

g. The Contractor shall include in each subcontract for property or services entered into by the Contractor and a first-tier Subcontractor, including a materials supplier, for the purpose of performing a construction contract, a payment clause that obligates the Contractor to pay the first-tier Subcontractor for satisfactory performance under its subcontract within ten (10) days out of such amounts as are paid to the Contractor by the Owner under such Contractor.

h. All employers, including Contractor, that employ subject workers who work under the Contract Documents in the State of Oregon shall comply with ORS 656.017 and provide the required Workers Compensation coverage, unless such employees are exempt under ORS 656.126. Contractor shall ensure that each of its subcontracts complies with these requirements.

i. As a condition to Owner's performance hereunder, Contractor shall promptly, as due, make payment to any person, co-partnership, association or corporation furnishing medical, surgical, and hospital care or other needed care and attention, incident to sickness or injury, to the employees of the Contractor, of all sums of

which the Contractor agrees to pay for the services and all moneys and sums that the Contractor collected or deducted from the wages of employees under any law, contract or agreement for the purpose of providing or paying for the services.

6. Payroll Certification and Fee Requirements.

   a. In accordance with ORS 279C.845, the Contractor and every Subcontractor shall submit written certified statements to the Owner on the form prescribed by the Commissioner of BOLI, certifying the hourly rate of wage paid each worker which the Contractor or the Subcontractor has employed on the Project and further certifying that no worker employed on the Project has been paid less than the prevailing rate of wage or less than the minimum hourly rate of wage specified in the Contract Documents, which certified and statement shall be verified by the oath of the Contractor or the Subcontractor that the Contractor or Subcontractor knows the contents of the certified statement, and, that to the Contractor's or Subcontractor's best knowledge and belief, the certified statement is true. The certified statements shall set out accurately and completely the payroll costs for the prior week, including the name and address for each worker, the worker's correct classification, rate of pay, daily and weekly number of hours worked, deductions made, and actual wages paid. Certified statements for each week during which the Contractor or Subcontractor has employed a worker on the Project shall be submitted once a month, by the fifth (5th) business day of the following month. The Contractor and Subcontractor shall preserve the certified statements for a period of ten (10) years from the date of completion of the Work.

   b. Pursuant to ORS 279C.845(7), the Owner shall retain 25 percent of any amount earned by the Contractor, in addition to other retainage, on the Work until the Contractor has filed the certified statements required above. The Owner shall pay the Contractor the amount retained under this subsection within 14 business days after the Contractor files the required certified statements, regardless of whether a Subcontractor has failed to file certified statements.

   c. Pursuant to ORS 279C.845(8), the Contractor shall retain 25 percent of any amount earned by a first-tier Subcontractor on this Project until the Subcontractor has filed with the Owner the certified statements required above. Before paying any amount required under this subsection, the Contractor shall verify that the first-tier Subcontractor has filed the certified statement. Within 14 days after the first-tier Subcontractor has filed the certified statement, the Contractor shall pay the first-tier Subcontractor any amount retained under this subsection.

7 Subcontracts. Contractor shall include in each first-tier subcontract, and shall require that each first-tier Subcontractor include in each lower-tier subcontract; clauses for payments, interest penalties and conditions as required under ORS 279C.580, which is incorporated herein by reference. Contractor shall certify that it shall not accept a bid from Subcontractors to perform Work unless such Subcontractors are registered with the Construction Contractors Board in accordance with ORS 701.021 at the time they submit their bids to the Contractor.

8. Environmental Pollution:

   a. In compliance with ORS 279C.525, lists of federal, state, and local agencies of which the Owner has knowledge that have enacted ordinances or regulations relating to

environmental pollution and the preservation of natural resources that may affect the performance of the Contract are listed in the 2015 Oregon Department of Transportation Standard Specifications for Construction, Section 00170.01.

b. If Contractor is delayed or must undertake additional work by reason of existing regulation or ordinances of agencies not cited herein, or due to enactment of new or the amendment of existing statutes, ordinances or regulations occurring after the submission of the successful Proposal, Owner may grant a time extension, a reasonable adjustment in the Cost of Work by issuance of a Change Order setting forth the additional work that must be undertaken. Such Change Order, if any, shall not invalidate the Agreement and shall, as applicable, increase the Agreement price to compensate Contractor for all costs and expenses incurred, including overhead and profits, as reasonable compensation of any such delay or additional work.

9. In accordance with ORS 279C.510, Contractor shall salvage or recycle construction and demolition debris if feasible and cost effective.

10. 10. Contractor shall comply with all requirements of ORS 279C.520 regarding hours worked. Workers employed by Contractor shall not be able to collect for unpaid overtime unless a claim is filed in accordance with ORS 279C.545 with Contractor.

11. Person claiming not being paid in full for supplied labor or materials for performance of the Work has right to file notice of such claim. Notice shall be filed in accordance with ORS 279C.605.

12. As applicable, Contractor shall comply with Clackamas County Code and Water Environment Services Rules and Regulations.

13. Contractor agrees to comply with the following, as applicable and as may be amended from time to time: i) Title VI and VII of the Civil Rights Act of 1964; ii) Section 503 and 504 of the Rehabilitation Act of 1973; iii) the Health Insurance Portability and Accountability Act of 1996; iv) the Americans with Disabilities Act of 1990; v) ORS Chapter 659A; vi) all regulations and administrative rules established pursuant to any applicable laws; and vii) all other applicable requirements of federal, state, county or other local government entity statutes, rules and regulations.

14. The following notice is applicable to Contractors who perform excavation Work: ATTENTION: Oregon law requires you to follow rules adopted by the Oregon Utility Notification Center. Those rules are set forth in OAR 952-001-0090. You may obtain copies of the rules by calling the center at (877) 668 4001.

15. Independent Contractor Status: The service or services performed under the Contract Documents are those of an independent contractor as defined in ORS 670.600. Contractor represents and warrants that it is not an officer, employee or agent of the Owner as those terms are used in ORS 30.265.

16. Retirement System Status and Taxes: Contractor represents and warrants that it is not a contributing member of the Public Employees' Retirement System and will be responsible for any federal or state taxes applicable to payment received under the Agreement. Contractor will not be eligible for any benefits from these payments under the Agreement of federal Social Security, employment insurance, workers' compensation or the Public Employees' Retirement System, except as a self-employed individual. Unless Contractor is subject to backup withholding, Owner will not withhold

from such payments any amount(s) to cover Contractor's federal or state tax obligations.

17. Government Employment Status: The Contractor represents and warrants that it is not currently employed by the Federal Government. This does not preclude the Contractor from holding another contract with the Federal Government.

19. Failure to comply with any or all of the requirements of Section 7.11.D shall be a material breach of the Contract and constitute grounds for Contract termination. Any and all damages or costs resulting from such noncompliance shall be the responsibility of Contractor.

7.12 *Record Documents*

SC-7.12 Amend Paragraph 7.12.A by adding "and Owner" after the word "Engineer" in the third sentence.

7.13 *Safety and Protection*

SC-7.13 Add the following directly after the last sentence of Paragraph 7.13.E:

Contractor shall be aware that permit-required confined spaces exist in or near the Project Site. Entry to these spaces must be accomplished in compliance with the requirements of OAR 166-150-0190 (29 CFR 1910.146). Examples of permit-required confined spaces include but are not limited to the following:

- Open tanks beyond the handrails including clarifiers, aeration basins, channels, etc.
- Manholes.
- Flow control structures which have the potential to contain sewage.
- Enclosed tanks including digesters, clarifiers, grit basins, chemical tanks, etc.
- Wet well and dry wells of pump stations.
- Headworks channels.
- Electrical vaults.

The hazards associated with these confined spaces may include but are not limited to:

- Oxygen deficiency.
- Combustible vapors including methane.
- Slip hazards.
- Fall/retrieval hazard.
- Engulfment hazard.
- Lockout required of mechanical and electrical devices.
- Toxic or hazardous chemicals including hydrogen sulfide and process chemicals.
- Traffic hazards.
- Hot work and ignition sources.
- Potential for rapid changes in working conditions.
- Painting or coating application activities often pose temporary hazards.

Prior to beginning Work in permit-required confined spaces, Contractor shall provide Owner with a copy of Contractor's permit-required confined space entry plan/program including a copy of the permit forms that will be used by Contractor. Upon request by Contractor, Owner

will review with Contractor, Owner's permit-required confined space program and specific procedures Owner would incorporate in spaces entered. Owner will coordinate any of its entries into the same spaces with Contractor. When the permit-required confined space Work is completed, Contractor shall inform Owner, in writing, of any hazards encountered or changes made resulting in different hazards within the space.

SC-7.13 Add the following new paragraphs immediately after Paragraph 7.13.J:

K. Contractor shall revise Contractor's plan for safety precautions and programs at appropriate times to reflect changes in construction conditions, the Work, Contractor's means, methods, techniques, sequences, and procedures of construction. Contractor shall disseminate the original plan and revisions to all others indicated in Paragraphs 7.13.C.1.

L. Contractor's plan for safety precautions and programs will not require more stringent safety requirements, training or other qualifications for all others than Contractor sets forth for comparable activity and responsibility of Contractor, Subcontractors and Suppliers and their respective employees.

7.15 *Emergencies*

SC-7.15 Amend Paragraph 7.15.A by adding the words "and Owner" immediately after the word "Engineer" in the second sentence.

7.17 *Contractor's General Warranty and Guarantee*

SC-7.17 Add the following new paragraph after Paragraph 7.17.D.9:

10. any acceptance by Owner or any failure to do so.

SC-7.17 Add the following new paragraph after Paragraph 7.17.E:

F. Contractor shall warrant the Work to be free of defects in materials and workmanship for a period of one year from the date of Substantial Completion by the Owner. The Contractor shall correct defective Work during the warranty period as described in the General Conditions.

7.18 *Indemnification*

SC-7.18 Delete Paragraph 7.18.A in its entirety and replace with the following:

A. Contractor shall be responsible for all damage to property, injury to persons, and loss, expense, inconvenience, and delay that may be caused by, or result from, the carrying out of the Work to be done under the Contract, or from any act, omission or neglect of the Contractor, its Subcontractors, employees, guests, visitors, invitees and agents.

To the fullest extent permitted by law, Contractor shall indemnify and defend (with counsel approved by Owner) the Owner, Clackamas County, and their elected officials, officers, directors, agents, and employees (collectively "Indemnitees") from and against all liabilities, damages, losses, claims, expenses (including attorney fees), demands and actions of any nature whatsoever which arise out of, result from or are related to: (a) any damage, injury, loss, expense, inconvenience or delay; (b) any accident or occurrence which happens or is alleged to have happened in or about the Project Site or any place where the Work is being performed, or in the vicinity of either, at any time prior to the time the Work is fully completed in all respects; (c) any failure of the Contractor to observe or perform any duty or obligation under the Contract Documents which is to be observed or performed by the Contractor, or any breach of any agreement, representation or warranty of the Contractor

contained in the Contract Documents or in any subcontract; (d) the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or any one of them or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder (except to the extent otherwise void under ORS 30.140); and (e) any lien filed upon the Project or bond claim in connection with the Work. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this section.

In addition, Contractor shall indemnify the Owner, Clackamas County, and their elected officials, officers, directors, agents, and employees from and against any and all actions, claims, fines, costs (including attorney fees) or damages incurred by Owner as a result of a violation of the Owner's National Pollutant Discharge Elimination System Permit, where such violations are the result of the Contractor's negligence. The Owner may withhold from any payments owed to the Contractor the amount of such fines, and a Change Order shall be issued to reflect any such reduction.

However, neither Contractor nor any attorney engaged by Contractor shall defend the claim in the name of Owner or Clackamas County ("County"), purport to act as legal representative of Owner or County, nor settle any claim on behalf of Owner or County without the prior approval of the Clackamas County Counsel's Office. Owner or County may assume their own defense and settlement at their election and expense.

SC-7.18 Amend paragraph 7.18.B by removing "or Engineer" from the first sentence.

ARTICLE 8—OTHER WORK AT THE SITE

8.02 *Coordination*

SC-8.02 Add the following new Paragraph 8.02.C immediately after Paragraph 8.02.B:

C. Other work anticipated to be performed at the Site by others that is not related to but coincides with the scheduled performance of the Work under these Contract Documents is described in Section 01 31 13, Project Coordination.

8.03 *Legal Relationships*

SC-8.03 Amend Paragraph 8.03.C by deleting both uses of the word "Engineer" from the first sentence.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.02 *Replacement of Engineer*

SC-9.02 Amend Paragraph 9.02.A by deleting the words "provided Contractor makes no reasonable objection to the replacement engineer."

9.05 *Lands and Easements; Reports, Tests, and Drawings*

SC-9.05 Delete Paragraph 9.05.C in its entirety and replace with the following:

D. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site relating to existing surface or subsurface

structures at the Site that have been utilized by Engineer in preparing the Contract Documents.

9.11 *Evidence of Financial Arrangements*

SC-9.11 Delete Paragraph 9.11.A in its entirety and replace with the following:

A. If and to the extent Owner has agreed to furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents, Owner's responsibility in respect thereof will be as set forth in the Supplementary Conditions.

ARTICLE 10—ENGINEER'S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

C. Resident Project Representative (RPR) will be furnished by the Engineer. The responsibilities, authority, and limitations of the RPR are limited to those of Engineer in accordance with Paragraph 10.08 and as set forth elsewhere in the Contract Documents and are further limited and described below. The RPR will:

1. *Schedules*: Review and monitor Progress Schedule, Schedule of Submittals, and Schedule of Values prepared by Contractor and consult with Engineer concerning acceptability.

2. *Conferences and Meetings:* Conduct or attend meetings with Contractor, such as preconstruction conferences, progress meetings, Work conferences and other Project related meetings.

3. *Liaison*

   a. Serve as Engineer's liaison with Contractor, working principally through Contractor's authorized representative, and assist in understanding the intent of the Contract Documents;

   b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's onsite operations;

   c. Assist in obtaining from Owner additional details or information when required for proper execution of the Work.

4. *Interpretation of Contract Documents*: Inform Engineer and Owner when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor technical clarifications and interpretations as issued by Engineer, or non-technical clarifications and interpretations of the Contract Documents issued by Owner.

5. *Submittals*: Receive submittals that are furnished at the Site by Contractor, and notify Engineer of availability for examination. Advise Engineer and Contractor of the commencement of any Work or arrival of materials and equipment at Site, when recognized, requiring a Shop Drawing or Sample if the submittal has not been approved by Engineer.

6. *Modifications*: Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and provide recommendations to Engineer; transmit to Contractor, in writing decisions as issued by Engineer.

7. *Review of Work and Rejection of Defective Work*:

    a. Conduct onsite observations of the Work in progress to assist Engineer in determining if the Work is, in general, proceeding in accordance with the Contract Documents.

    b. Inform Engineer and Contractor whenever RPR believes that any Work is defective.

    c. Advise Engineer whenever RPR believes that any Work will not produce a completed Project that conforms generally to the Contract Documents or will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated in the Contract Documents, whenever RPR believes Work should be uncovered for observation, or requires special testing, inspection, or approval.

    d. Monitor to ensure that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof.

    e. Observe, record and report to Engineer appropriate details relative to the test procedures and startups.

    f. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to the Engineer.

8. *Inspections, Tests, and System Startups*:

    a. Verify tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof.

    b. Observe, record, and report to Engineer appropriate details relative to the test procedures and system startups.

    c. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections, and report to Engineer.

9. *Records*:

    a. Maintain at the Site files for correspondence, conference records, Submittals including Shop Drawings and Samples, reproductions of original Contract Documents including all Addenda, the signed Agreement, Written Amendments, Work Change Directives, Change Orders, Field Orders, additional Drawings issued after the Effective Date of the Agreement, Engineer's written clarifications and interpretations, progress reports, and other Project related documents.

    b. Keep a record of pertinent Site conditions, activities, decisions and events.

10. *Reports*:

a. Furnish Engineer periodic reports of progress of the Work and of Contractor's compliance with the Progress Schedule and Schedule of Submittals.

b. Consult with Engineer in advance of scheduled major tests, inspections or start of important phases of the Work.

c. Assist in drafting proposed Change Orders, Work Change Directives, and Field Orders, and obtain backup material from Contractor as appropriate.

11. *Payment Requests*: Review Applications for Payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the Schedule of Values, Work completed, and materials and equipment delivered at the Site but not incorporated in the Work.

12. *Certificates, Operation and Maintenance Manuals*: During the course of the Work, verify materials and equipment certificates and operation and maintenance manuals and other data required by Specifications to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and ensure these documents have been delivered to Engineer for review and forwarding to Owner prior to payment for that part of the Work.

13. *Substantial Completion*:

    a. Conduct an inspection in the company of Engineer, Owner, and Contractor and prepare a list of items to be completed or corrected.

    b. Submit to Engineer a list of observed items requiring completion or correction.

14. *Final Completion*:

    a. Conduct final inspection in the company of Engineer, Owner, and Contractor.

    b. Notify Contractor and Engineer in writing of all particulars in which this inspection reveals that the Work is incomplete or defective.

    c. Observe that all items on final list have been completed, corrected, or accepted by Owner and make recommendations to Engineer concerning acceptance.

D. The RPR will not:

1. Have authority to authorize a deviation from Contract Documents or substitution of materials or equipment, unless authorized by Owner.

2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.

3. Undertake any of the responsibilities of Contractor, Subcontractors, Suppliers, or or Contractor's authorized representative.

4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction, unless such advice or directions are specifically required by the Contract Documents.

5 Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.

6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Owner.

7. Accept shop drawings or samples from anyone other than Contractor.

8. Authorize Owner to occupy the Project in whole or in part.

9. Take an action that would affect Owner's obligations related to scope or schedule of the Work.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

SC-10.06 Delete the last sentence of Paragraph 10.06.A and replace it with the following:

In rendering such decisions and judgments, Engineer will not show partiality to the Owner or Contractor. If a dispute, matter for interpretation or need for judgment arises that includes allegations against the Engineer, then the Engineer shall not be the party deciding that matter.

10.07 *Limitations on Engineer's Authority and Responsibilities*

SC-10.07 Add the following new paragraph immediately after Paragraph 10.07.E:

F. Only the Owner has the authority to authorize modifications of the Contract Documents, additional Work, or changes the Contract Time or Contract Price.

ARTICLE 11—CHANGES TO THE CONTRACT

11.02 *Change Orders*

SC-11.02 Delete Paragraph 11.02.B in its entirety.

11.07 *Change of Contract Price*

SC-11.07 Amend Paragraph 11.07.C.2.a by replacing "15" with "10".

SC-11.07 Amend Paragraph 11.07.C.2.c by replacing "15" with "10".

SC-11.07 Add the following new paragraph immediately after Paragraph 11.07.C:

E. In the event Contractor submits request for additional compensation as a result of a change or differing Site conditions, or as a result of delays, acceleration, or loss of productivity, Owner reserves right, upon written request, to audit and inspect Contractor's books and records relating to the Project. Upon written request for an audit, Contractor shall make its books and records available within 14 days of request. Owner shall specifically designate the identity of the auditor. As part of audit, Contractor shall make available its books and records relating to the Project, including, but not limited to, Bidding Documents, cost reports, payroll records, material invoices, subcontracts, purchase orders, daily timesheets, and daily diaries. Audit shall be limited to those cost items that are sought by Contractor in a Change Order or Claim submission to Owner.

11.08 *Change of Contract Times*

SC-11.08 Add the following to Paragraph 11.08.B:

All requests for time extensions shall be supported by Schedule analysis showing the effect on the entire Project taking into account concurrent Work and the critical path, including

Float. Partial demonstration of impact on particular operations only will not be acceptable to show the criticality of any event on the Project Schedule as a whole.

SC-11.08 Add the following new paragraphs immediately following Paragraph 11.08.B:

C. *Use of Float*:

1. A claim for an adjustment of Contract Times (or Milestones), otherwise allowable under the Contract Documents, shall be granted only when the time lost or gained exceeds the float for the activity at the time of the event giving rise to the claim. Float is jointly owned by both Owner and Contractor, whether expressly disclosed or implied in any manner.

2. Contractor shall not use Float suppression techniques (including, but not limited to, preferential sequencing caused by late starts of follow-up trades, unreasonably small crews, extended durations, or imposed dates) in information provided to Owner or Engineer.

ARTICLE 12—CLAIMS

12.01 *Claims*

SC-12.01 Delete Paragraph 12.01.A.1 in its entirety and replace with the following:

1. Appeals by the Contractor of Owner's decisions regarding Change Proposals;

SC-12.01 Add the following language to the end of the sentence in Paragraph 12.01.D.3:

"for disputes involving the Owner and Contractor."

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01 *Cost of the Work*

SC-13.01 Amend Paragraph 13.01.B.1 by deleting the third sentence and replacing it with the following language:

Labor costs for employees in the direct employ of Contractor in the performance of the Work will be the actual cost for wages in accordance with the Oregon BOLI Prevailing Wage Rates for Public Works Contracts in Oregon (see SC-7.10.D.1.a for specific BOLI publication) for each craft or type of workers performing the Work at the time the Work is done, plus BOLI's established Fringe Rate for employer payments of payroll taxes, worker compensation insurance, liability insurance, health and welfare, pension, vacation, apprenticeship funds, and other direct costs resulting from Federal, State or local laws, as well as assessments or benefits required by lawful collective bargaining agreements. Labor costs for equipment operators and helpers will be paid only when such costs are not included in the invoice for

equipment rental. The labor costs for foremen and superintendents shall be proportioned to all of their assigned Work and only that applicable to extra Work shall be paid.

SC-13.01 In Paragraph 13.01.B.4, delete the word “special” and replace with the word “technical,” and delete the parenthetical phrase “(including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants)” in its entirety.

SC-13.01 Delete Paragraph 13.01.B.5.c in its entirety and replace with the following:

c. Rentals of construction equipment at the rental rate listed for such equipment specified in the current edition of the “Contractor’s Equipment Cost Guide” as published by Equipment Watch (www.equipmentwatch.com), telephone number 800/699-3282, or from rate sheets from local rental companies. Such rental rate will be used to compute payments for equipment whether the equipment is under the Contractor’s control through direct ownership, leasing, renting, or another method of acquisition. The rental rate to be applied for use of each item of equipment will be the rate resulting in the least total cost to the Owner for the total period of use. If it is deemed necessary by the Contractor to use the equipment not listed by the references specified herein, an equitable rental rate for the equipment will be established by the Engineer. The Contractor may furnish cost data which might assist the Engineer in the establishment of the rental rate. Payment shall be subject to the following:

1) Payment for equipment which is already on the Project Site and which is used in the completion of Work will not be allowed;

2) All equipment shall, in the opinion of the Engineer, be in good working condition and suitable for the purpose for which the equipment is to be used;

3) Before construction equipment is used on the extra Work, the Contractor shall plainly stencil or stamp an identifying number thereon at a conspicuous location, and shall furnish to the Engineer, in duplicate, a description of the equipment and its identifying number;

4) Unless otherwise specified, manufacturer’s ratings and manufacturer approved modifications shall be used to classify equipment for the determination of applicable rental rates. Equipment which has no direct power unit shall be powered by a unit of at least minimum rating recommended by the manufacturer;

5) Individual pieces of equipment or tools having a replacement value of $400 or less, whether or not consumed by use, will be considered to be small tools and no payment will be made therefore; and

6) Rental time will not be allowed while equipment is inoperative due to breakdowns.

The rental time to be paid for equipment at the Site will be the time the equipment is in productive operation on the Work being performed and, in addition, will include the time required to move the equipment to the location of the extra Work and return it to the original location or to another location; except, that moving time will not be paid if the equipment is used on other than the Work, even though located at the Site of the Work. Loading and transporting costs will be allowed, in lieu of moving time, when the equipment is moved by means other than its own power, except that no

payment will be made for loading and transporting costs when the equipment is used at the Site of the Work on other than the Work related to the Change Order, Change proposal, Claim, set-off, or other adjustment in Contract Price. Rental time will not be allowed while equipment is inoperative due to breakdowns. The rental time of equipment on the Work Site will be computed subject to the following:

1) When hourly rates are listed, any part of an hour less than 30 minutes of operation will be considered to be one-half hour of operation, and any part of an hour in excess of 30 minutes will be considered 1 hour of operation;

2) When daily rates are listed, any part of a day less than 4 hours operation will be considered to be half-day of operation. When Owner -operated equipment is used to perform extra Work to be paid from on time and materials basis, the Contractor will be paid for the equipment and operator, as follows;

a) Payment for the equipment will be made in accordance with the provisions in Paragraph 13.01.B.5.c above;

b) Payment for the cost of labor and subsistence or travel allowance will be made at the rates established in Paragraph SC-13.01.B.1; and

c) The direct cost of equipment rental and labor, computed as provided herein, will be added the allowances for equipment rental and labor as provided in Section 00 72 00, General Conditions, Paragraph 13.01.D.

SC-13.01 Add the following language to the end of Paragraph 13.01.B.5.h:

Express and courier services must be approved prior to use.

SC-13.01 Supplement Paragraph 13.01.C.2 by adding the following sentence at the end of the existing language:

For purposes of this paragraph, “small tools and hand tools” means any tool or equipment whose current price if it were purchased new at retail would be less than $500.

SC-13.01 Amend Paragraph 13.01.E by deleting the word “three” in the third sentence and replacing it with “ten”.

SC-13.01 Add the following to Paragraph 13.01.E:

Supporting data shall include but not be limited to daily submissions of timesheets indicating hours and trades worked, equipment and time equipment was employed, and materials expended. Also see SC-7.11.D.6.

If for any reason, any part of the Work or the Contract shall be subject to litigation, Contractor shall retain all such records until all litigation is resolved and Contractor shall continue to provide Owner and/or its agents with full access to such records until such time as all litigation is complete and all periods for appeal have expired and full and final satisfaction of any judgment, order or decree is recorded and Owner receives a record copy of documentation from Contractor.

13.03 *Unit Price Work*

SC-13.03 DELETE and REPLACE subparagraph 13.03.E1.a as follows

a. If the Bid price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price and the quantity of the item of Unit Price Work performed by

Contractor differs materially and significantly by more than 15 percent from the estimated quantity of such item indicated in the Agreement. The award, or non-award, of bid alternates shall not be considered cause for adjustment of unit price irrespective of change in actual quantities compared to estimated quantities on the bid form.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCCEPTANCE OF DEFECTIVE WORK

14.02 *Tests , Inspections, and Approvals*

SC-14.02 Delete Paragraph 14.02.A in its entirety and replace with the following:

A. Contractor shall notify Engineer 48 hours prior to the expected time for operations requiring inspection and laboratory testing services. Contractor shall cooperate with inspection and testing personnel and furnish samples of materials, design mix, equipment, tools, storage and assistance as requested.

SC-14.02 Add the following to the end of Paragraph 14.02.D:

Tests required by Contract Documents to be performed by Contractor that require test certificates be submitted to Owner or Engineer for acceptance shall be made by an independent testing laboratory or agency licensed or certified in accordance with Laws and Regulations and applicable state and local statutes. In the event state license or certification is not required, testing laboratories or agencies shall meet the following applicable requirements:

1. "Recommended Requirements for Independent Laboratory Qualification," published by the American Council of Independent Laboratories.
2. Basic requirements of ASTM E329, "Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction" as applicable.
3. Calibrate testing equipment at reasonable intervals by devices of accuracy traceable to either the National Bureau of Standards or accepted values of natural physical constants.

Prior to requesting a certificate of Substantial Completion, and allowing occupancy of facilities, Contractor shall provide an inspection by a state industrial safety representative, by an independent safety inspector certified by the state in the construction type being inspected, or a federal or state (OSHA) representative qualified in the construction type being inspected, to determine that the facilities provided are in compliance with the state and federal safety requirements. Signed copies of the inspection reports shall be submitted

to the Engineer for Owner's files. Violations or deficiencies noted therein shall be resolved prior to occupancy of the facilities and before final payment will be made.

14.03 *Defective Work*

SC 14.03 Add the following language to Paragraph 14.07.C:

If the Owner is unable to use set-offs to recover the total amount owed under this provision, then Owner may use any and all available methods for recovering the remaining amounts from Contractor.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

15.01 *Progress Payments*

SC-15.01 Amend paragraph 15.01.A by adding the following after the last sentence:

The Owner will make progress payments in accordance with ORS 279C.570.

SC-15.01 Add the following subparagraphs after Paragraph 15.01.B.4:

5. Stored Material and Equipment: Payments for stored materials and equipment shall be based only upon the actual cost of the materials and equipment to Contractor and shall not include any overhead or profit to Contractor. Partial payments will not be made for undelivered materials or equipment.

6. Schedule and Data: During the progress of the Work, each Application for payment shall be accompanied by Contractors updated schedule of operations, or progress report, with Shop Drawings schedules, procurement schedules, and value of materials on had included in the application and other data specified in Section 01 33 00, Submittal Procedures, or reasonably required by Engineer.

7. Unless otherwise indicated in the Contract Documents, partial payment for Equipment shall be as follows:

    a) 5 percent upon final approval of Shop Drawings by Engineer or Owner.

    b) 55 percent upon delivery of goods.

    c) 35 percent upon start-up and final acceptance by Engineer or Owner in accordance with Paragraph 15.04.

    d) 5 percent upon delivery of operations and maintenance manuals.

8. Total price for mobilization shall not exceed 1.0 percent of the Contract Price. Total price for demobilization shall not be less than 2.0 percent of the Contract Price.

SC-15.01 Amend Paragraph 15.01.E.1 by adding the following at the end:

m. Any funds retained pursuant to SC-7.11.D.6, SC-7.18 and SC-15.03.B.

SC--15.01 Add the following new paragraph immediately after Paragraph 15.01.E:

F. Subcontractor Payments. Contractor shall make payments to Subcontractors in accordance with SC-7.11.D.

15.03 *Substantial Completion*

SC-15.03. Amend Paragraph 15.03.A by adding the following:

Conditions precedent to Substantial Completion of the Work and Engineer's issuance of a Certificate of Substantial Completion shall include:

a. Conformance with all training services requirements and deliverables.

b. Submittal of current record documents to the Owner and Engineer.

c. Submittals have been received and approved or accepted by Engineer including, but not limited to, the following:

i. Approved Shop Drawings;

ii. Electrical testing and wiring diagram;

iii. Equipment data forms;

iv. Manufacturer's certificates of proper installation;

v. Factory test reports;

vi. Commissioning, testing and startup reports;

vii. Final Operations and Maintenance Manuals;

viii. Extra materials (spare parts) (as specified).

SC-15.03 Add the following new subparagraph to Paragraph 15.03.B:

1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.

15.06 *Final Payment*

SC-15.06 Add the following new paragraph immediately after Paragraph 15.06.A.2.e:

f. In accordance with ORS 279A.120, when out of state Contractor is awarded a Contract, Contractor is required to report to the Department of Revenue the Contract Price, terms of payment, length of Contract, and other information as Department of Revenue

may require. Owner will verify Contractor has satisfied this requirement prior to issuing final payment.

15.07 *Waiver of Claims*

SC-15.07 Delete Paragraph 15.07.A in its entirety.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

SC-16.01 Amend Paragraph 16.01.A by adding the following language to the end of the third sentence:

"unless the cause for delay is due to the negligence of Contractor or anyone whom Contractor has the responsibility or right to control."

16.02 *Owner May Terminate for Cause*

SC-16.02. Amend Paragraph 16.02.A by adding the following at the end of the sentence:

"in a manner consistent with ORS 279C.670."

16.04 *Contractor May Stop Work or Terminate*

SC-16.04. Delete Paragraph 16.04 in its entirety.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

17.02 *Litigation*

SC-17.02 Add the following new paragraph immediately after Paragraph 17.01.

17.02 *Litigation*

A. Any Claim between Owner and Contractor that arises from or relates to the Contract and that is not resolved through the Claims Review Process or resolved through an alternative dispute resolution process agreed upon by the Parties shall be brought and conducted solely and exclusively within the Circuit Court of Clackamas County for the State of Oregon; provided, however, if a Claim must be brought in a federal forum, then it shall be brought and conducted solely and exclusively within the United States District Court for the District of Oregon. In no event shall this section be construed as a waiver by the County of any form of defense or immunity, whether sovereign immunity, governmental immunity, immunity based on the Eleventh Amendment to the Constitution of the United States or otherwise, from any claim or from the jurisdiction of any court. CONTRACTOR, BY EXECUTION OF THE CONTRACT, HEREBY CONSENTS TO THE IN PERSONAM JURISDICTION OF THE COURTS REFERENCED IN THIS SECTION.

ARTICLE 18—MISCELLANEOUS

18.06 *Survival of Obligations*

SC-18.06. Amend Paragraph 18.06.A by adding the following directly after the last sentence:

All warranty and indemnification provisions of the Contract, and all of Contractor's other obligations under the contract that are not fully performed by the time of final completion

or termination, shall survive final completion, final acceptance, or any termination of the Contract.

18.07 *Controlling Law*

SC-18.07 Delete Paragraph 18.07.A in its entirety and replace with the following:

A. This Contract is governed by the laws of the State of Oregon without giving effect to the conflict of law provisions thereof.

18.11 *General Provisions*

SC-18.11 Add the following after Paragraph 18.10:

18.11 *General Provisions*

A. No Third Party Beneficiaries: Owner and Contractor are the only parties to the Contract and are the only parties entitled to enforce its terms. Nothing in the Contract gives, is intended to give, or shall be construed to give or provide any benefit or right, whether directly, indirectly, or otherwise, to third persons unless such third persons are individually identified by name herein and expressly described as intended beneficiaries of the terms of the Contract.

B. Severability: If any provision of the Contract is declared by a court to be unenforceable, illegal, or in conflict with any law, the validity of the remaining terms and provisions shall not be affected and the rights and obligations of the parties shall be construed and enforced as if the Contract did not contain the particular provision held to be invalid.

C. Non-Exclusive Rights and Remedies: Except as otherwise expressly provided herein, the rights and remedies expressly afforded under the provisions of the Contract shall not be deemed exclusive, and shall be in addition to and cumulative with any and all rights and remedies otherwise available at law or in equity. The exercise by either Party of any one or more of such remedies shall not preclude the exercise by it, at the same or different times, of any other remedies for the same default or breach, or for any other default or breach, by the other Party.

D. Debt Limitation: The Contract is expressly subject to the debt limitation of Oregon counties set forth in Article XI, Section 10, of the Oregon Constitution, and is contingent upon funds being appropriated therefore. Any provisions herein which would conflict with law are deemed inoperative to that extent.

E. No Attorney Fees: In the event any arbitration, action or proceeding, including any bankruptcy proceeding, is instituted to enforce any term of this Contract, each party shall be responsible for its own attorneys' fees and expenses.

EXHIBIT E

Specifications

CLACKAMAS
WATER ENVIRONMENT SERVICES

OREGON CITY, OREGON

CONTRACT DOCUMENTS

for the construction of the

TRI-CITY WRRF PRIMARY CLARIFIER REHABILITATION

WES Project No. P632324

****

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JACOBS

Corvallis, Oregon

June 2022

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Project No. 692260CH Copy No. _____

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DIVISION 02—EXISTING CONDITIONS

DIVISION 32—EXTERIOR IMPROVEMENTS

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Todd W. Dye

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SPECIFICATIONS

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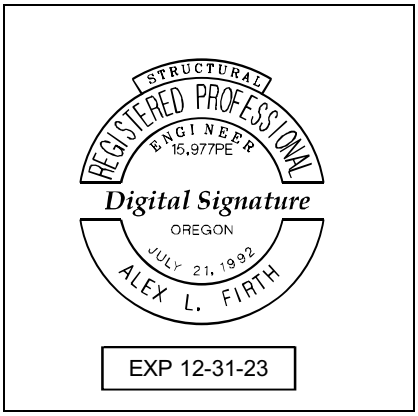
(01 45 33, 01 88 15)
DIVISION 03—CONCRETE
DIVISION 05—METALS



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SPECIFICATIONS

DIVISION 07—THERMAL AND MOISTURE PROTECTION
DIVISION 08—OPENINGS
DIVISION 09—FINISHES

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SPECIFICATIONS

DIVISION 22—PLUMBING
DIVISION 23—HEATING, VENTILATING, AIR-CONDITIONING (HVAC)

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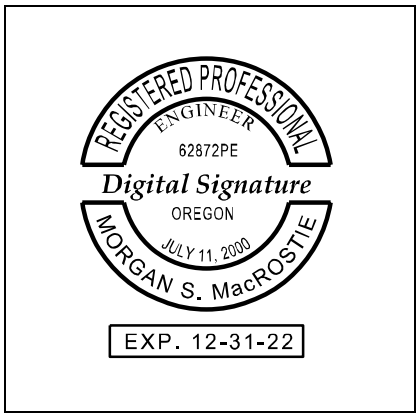
SPECIFICATIONS
DIVISION 26—ELECTRICAL



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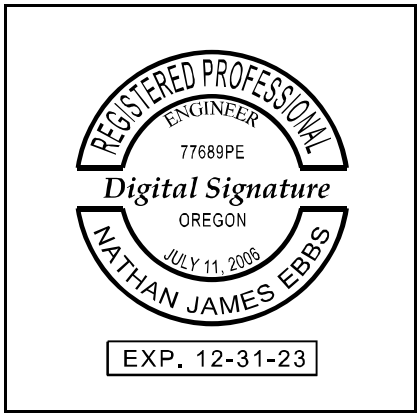

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SPECIFICATIONS
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Lionel L. Wood

END OF SECTION

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END OF SECTION

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SPECIFICATIONS

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

A. The completed Work will provide Owner with construction of new facilities and modifications to existing facilities as follows:

1. Primary Clarification:
   a. Replace existing longitudinal and cross collector mechanisms in Clarifier 1 through Clarifier 6.
   b. Replace existing helical scum skimmer in Clarifier 1 through Clarifier 6.
   c. Replace selected deteriorated launder troughs Clarifier 1 through Clarifier 6.
   d. Replace in-basin piping and pipe supports Clarifier 1 through Clarifier 6.
   e. Replace corroded electrical cabinet, conduits, and circuits in Primary Building (Facility 210).
   f. Provide new electrical and control circuits to new clarifier mechanisms.
   g. Provide new local control panels and motor control center starter units for new clarifier equipment.
   h. Demolish existing abandoned HVAC equipment including hydronic heating system components.
   i. Provide new HVAC air supply fans in Primary Building (Facility 210).
   j. Provide combustible gas detection and alarming for Primary Building (Facility 210).
   k. Replace door frames, doors, and hardware in Primary Building (Facility 210).
   l. Repair cracks in existing concrete influent channel and Clarifier 1 through Clarifier 6.
   m. Clean, repair/replace existing concrete joints and sealants in primary influent channel and Clarifier 1 through Clarifier 6.
   n. Replace existing concrete embedded rails upon which clarifier flights ride.
   o. Repair substantial portions of existing primary influent channel and interior clarifier walls, floor, and head space of Clarifier 1 through Clarifier 6, by removing deteriorated concrete surface and providing new concrete repair products.

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p. Provide all ancillary structural, mechanical, electrical, HVAC, and instrumentation and controls equipment, products, materials, and appurtenances related to the scope items listed above.

B. Alternates:

1. Only those alternates that were selected by the Owner, as evidenced in the Agreement, are made a part of this Contract.
2. Alternates that were Bid were as described below:
   a. None.

1.02 WORK NOT COVERED BY CONTRACT DOCUMENTS

A. As shown.

1.03 PROVISIONS FOR FUTURE WORK

A. Provisions for future construction are as shown.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational:

1. Work Sequence Plan: Submit within 30 days of Notice to Proceed.
2. Videotape survey, photographs, and other data of the preconstruction conditions shall be submitted to the Engineer for record purposes prior to, but not more than 3 weeks before, commencement of any construction activities.
3. A complete set of all photographs and survey data of the post-construction conditions shall be completed and submitted prior to final inspection by the Owner and Engineer.
4. Removal from Service Requests.
5. Temporary Power Plans.

1.02 RELATED WORK AT SITE

A. General:

1. Other work that is either directly or indirectly related to scheduled performance of the Work under these Contract Documents, listed henceforth, is anticipated to be performed at Site by others.
2. Coordinate the Work of these Contract Documents with work of others as specified in General Conditions.
3. Include sequencing constraints specified herein as a part of Progress Schedule.

B. Other Concurrent Work: The Owner and Owner’s contractors may be performing the following work during a period concurrent with the Work.

1. Influent Pump Station Improvements.
2. Administration Building Remodel.
3. Primary Clarifier 5: Chain replacement/maintenance (2023).
4. Primary Clarifier 6: Chain replacement/maintenance (2024).
5. Grit pumps maintenance and rehabilitation.
6. Chlorine Contact Basin Isolation Gate Replacement.
7. Laboratory Roof Replacement.
8. Laboratory Emergency Generator.
9. Other maintenance work in response to operations needs.

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C. Applications Software Development:

1. Owner's Integrator of Record will perform programming of applications software for certain portions of Process Instrumentation and Control Subsystem (PICS). Refer to Section 40 90 00, Instrumentation and Control for Process Systems, for detailed information pertaining to Integrator of Record programming.
   a. Sequencing: Include sequencing constraints specified herein as part of Progress Schedule.
2. Following Contractor completion of Functional Test Part 1, specified in Section 40 90 00, Instrumentation and Control for Process Systems, allow 10 working days for Functional Test Part 2 for each PLC area.
   a. When applications software testing is delayed because of altered equipment interfaces, receipt of incorrect Shop Drawing information, failed equipment, or incomplete Functional Test Part 1 testing, duration of delay will be excluded from interruption allowance, unless notified otherwise by Engineer and Owner.

1.03 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during the Work.

1. Clackamas County Sheriff: (503) 655-8218.
2. Water Environment Services: (503) 742-4567.
3. Portland General Electric: (503) 228-6322.
4. Comcast: (800) 266-2278.
5. NW Natural: (503) 226-4211.
6. Qwest: (877) 348-9007.
7. Oregon Utility Notification Center: (800) 332-2344.

1.04 PROJECT MILESTONES

A. General: Include the Milestones specified herein as a part of the Progress Schedule required under Section 01 32 00, Construction Progress Documentation.

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B. Project Milestones:

1. Generally described in the Agreement Form. Following is a detailed description of each:

No.	Milestone	Substantial Completion (Date or Calendars Days from Notice to Proceed)
1	Primary Building Improvements and Rehabilitation, Substantial Completion, and Return to Service of First and Second Primary Clarifiers	September 30, 2023
2	Rehabilitation, Substantial Completion, and Return to Service of Third and Fourth Primary Clarifiers	September 30, 2024
3	Rehabilitation, Substantial Completion and Return to Service of Fifth and Sixth Primary Clarifiers	September 30, 2025
4	Substantial Completion of Entire Contract	As specified in the Agreement
5	Final Completion of Entire Contract	As specified in the Agreement

2. Milestone 1 Definition:
   a. For Work of "Milestone 1: Primary Building Improvements and Rehabilitation, Substantial Completion, and Return to Service of First and Second Primary Clarifiers" and to be considered substantially complete, the following activities and Work shall be complete:
      1) Demolish existing abandoned HVAC equipment including hydronic heating system components.
      2) Replace corroded electrical cabinet, conduits, and circuits in Primary Building (Facility 210).
      3) Provide new HVAC air supply fans in Primary Building (Facility 210).
      4) Installation of combustible gas detection and alarming for Primary Building (Facility 210).
      5) Replacement of door frames, doors and hardware in Primary Building (Facility 210).

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6) Repair primary influent channel walls, floor, and head space adjacent to first and second primary clarifiers by repairing cracks, removing deteriorated concrete surface, and providing new concrete repair products including all manufacturer recommended curing times.
7) Concrete crack repair, concrete joint cleaning and sealing, concrete surface rehabilitation and concrete resurfacing in the primary clarifier basins including all manufacturer recommended curing times.
8) Installation of in basin piping and all associated valves, appurtenances and pipe supports.
9) Installation of longitudinal and cross sludge collector mechanisms.
10) Installation of helical scum skimmers.
11) Installation of launder troughs.
12) Completion of all bypass pumping activities (where required).
13) Installation of electrical items associated with the process equipment listed above under this milestone, including local control panels, motor control center starter units, and all associated conduit and wiring.
14) Installation of instrumentation and controls associated with the process equipment listed above under this milestone.
15) Functional and performance testing of equipment listed under this Milestone.
16) Return of both rehabilitated primary clarifiers to service at full operational capacity as documented in a Completed Facility Performance Demonstration/Certification Form.

3. Milestone 2 Definition:
   a. For Work of “Milestone 2: Rehabilitation, Substantial Completion, and Return to Service of Third and Fourth Primary Clarifiers” to be considered substantially complete, the following activities and Work shall be complete:
      1) Same as listed for Items 7 through 16 of Milestone 1, as applied to the third and fourth primary clarifiers.
      2) Repair primary influent channel adjacent to third and fourth primary clarifiers.
         a) Install, operate, maintain, and decommission bypass pumping system to support primary influent channel work.
         b) Clean existing concrete joints and replacing sealants.
         c) Repair cracks in existing concrete.

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d) Remove deteriorated concrete surface on the channel walls, floor, and head space and providing new concrete repair products including all manufacturer recommended curing times.

3) Install two slide gate replacements in channel adjacent to the third and fourth primary clarifiers.

4. Milestone 3 Definition:
   a. For Work of "Milestone 3: Rehabilitation, Substantial Completion, and Return to Service of Fifth and Sixth Primary Clarifiers" to be considered substantially complete, the following activities and Work shall be complete:
      1) Same as listed for Items 7 through 16 of Milestone 1, as applied to the fifth and sixth primary clarifier basins.
      2) Same as listed for Item 2 of Milestone 2, as applied to the fifth and sixth primary clarifiers.
5. Work of Milestone 2 and 3 is subject to authorization of bid alternates. See Instructions to Bidders.

1.05 EXISTING TREATMENT PLANT

A. The Work shall be executed while the existing wastewater treatment facilities are in operation. Operation of the existing facility shall not be jeopardized nor shall the efficiency or volume of wastewater conveyance be reduced as a result of the execution of the Work. Impairing the operational capabilities of the treatment plant will result in serious environmental damage and monetary fines. Conduct work in a manner that will not impair the operational capabilities of essential elements of the treatment process or reduce the capacity of the entire treatment plant below levels sufficient to treat the quality of raw wastewater to the water quality limitations specified in the discharge permit. Contractor shall be responsible for fines or other monetary damages that are a direct result of Contractor's failure to complete work in a timely fashion or other deficiencies that result in permit violations or measures to mitigate operational impacts to existing treatment plant operations. The status of the treatment plant shall be defined as "operational" when it is capable of treating the entire quantity of wastewater received to the water quality limits specified in the discharge permit.

B. The construction sequence and constraints in this section do not include all items affecting the completion of the Work but are intended to describe the sequence of critical events and associated constraints necessary to minimize disruption of the ongoing treatment plant processes and to ensure compliance with NPDES Permit requirements. It shall be understood and agreed by the Contractor that the critical events described are not all inclusive and that additional items of work not included may be required to minimize disruption

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and ensure compliance. Deviation from or modification of the suggested sequence is permitted if techniques and methods known to the Contractor will result in reducing disruption to the facility operation and maintaining treatment efficiency, avoiding violation of scheduling constraints, and if deviation is approved in advance by the Engineer.

C. Maintain traffic on existing roads as specified in Section 01 50 00, Temporary Facilities and Controls.

1.06 GENERAL WORK SEQUENCING CONSTRAINTS

A. For the purposes of this Article General Work Sequencing Constraints, and the following Article Facility Operations and Work Sequence section, terms such as "…work…must be completed" and "…completed and in operation", and "...in successful operation" are defined as meeting the terms of "Substantial Completion" and "Partial Substantial Completion" as defined in the General Conditions and Supplementary Conditions.

B. Include the following work sequencing constraints in the Progress Schedule:

1. Work requiring primary clarifiers to be out of service, and all temporary bulkhead installations shall occur in the dry season between June 1, and September 30 annually unless approved by Owner.
2. A maximum of two primary clarifiers may be out of service concurrently except as noted below. The Work sequence is anticipated to require three construction phases occurring during the dry seasons in 2023, 2024, and 2025. Phase 1 Work will include rehabilitation of Primary Clarifiers 1 and 2 in 2023, Phase 2 includes rehabilitation of Primary Clarifiers 3 and 4 in 2024, and Phase 3 includes rehabilitation of Primary Clarifiers 5 and 6 in 2025.
3. Existing scum system, and scum launder shall remain in service continually to allow operation of all in service primary clarifiers throughout each construction period. Contractor shall provide means of protecting and maintaining scum launders during concrete repair and resurfacing operation to prevent blast media and concrete debris from entering launders.
4. During Phase 1, Primary Clarifier 3 may be removed from service during the 2023 dry season for a single period not to exceed 14 days (while Primary Clarifiers 1 and 2 are out of service to perform the Work) to allow penetrations through the common wall between Primary Clarifier 3 and Primary Clarifier 2 to be made, pipes installed through wall, and other related work. Primary Clarifier 3 may not be taken out of service prior to July 15, 2023 (to avoid conflict with Primary Clarifier 5

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being taken out of service by Owner for chain replacement/maintenance).

5. During Phase 2, Primary Clarifier 5 may be removed from service during the 2024 dry season for a single period not to exceed 14 days (while Primary Clarifiers 3 and 4 are out of service to perform the Work) to allow penetrations in the common wall between Primary Clarifier 4 and 5 to be made, pipes installed through wall, and other related work. Primary Clarifier 5 may not be taken out of service prior to July 15, 2024 (to avoid conflict with Primary Clarifier 6 being taken out of service by Owner for chain replacement/maintenance).
6. Electrical shutdowns as required to accomplish work shall not exceed the periods shown below unless generator power is provided. All electrical shutdowns shall occur only on Tuesdays, Wednesdays, and Thursdays. Repeated shutdowns shall not be allowed, and multiple shutdowns of the same equipment must be separated by 48 hours.
    a. In service Primary Clarifiers: 8 hours (only one in service primary clarifier may be taken offline at a time for the specified duration).
    b. Disinfection (Chlorine/Sodium Bisulfite Systems): 0 hours, no shutdowns allowed without generator power.
    c. Primary Scum Pumping: 24 hours.
    d. Control Panel, LP-S1: 8 hours.
7. Primary Effluent Sampler, 350-2180, shall be considered critical to facility operations and shall run continuously. Backup power, via generator or another power source, accepted by Owner, shall be supplied during all planned outages.
8. Work related to combustible gas detection system and ventilation improvements can occur at any time.
9. Work related to demolition of abandoned hydronic heating system can occur at any time.
10. Site civil work and plant utilities work will be conducted throughout the overall construction schedule, integrated into the project elements described above as specific areas of the Site are impacted.
11. More detailed constraints are given in Article Facility Operations and Work Sequence below.
12. Software Functional Testing (FT) of the Programmable Logic Controller (PLC) software is broken in to two parts and described in Section 40 90 00, Instrumentation and Control for Process Systems:
    a. FT Part 1 is performed by Contractor or PIC System Integrator without the PLC software. It is only considered complete when the entire facility is complete.
    b. FT Part 2 can only commence after FT Part 1 is complete (per facility). FT Part 2 is performed by the Contractor or PIC System Integrator, as well as the Owner's Integrator of Record with the PLC software.

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c. Owner's Integrator of Record software programming requires up to 10 working days for testing, Contractor shall allow 10 working dates in their schedule for each unit process startup.

1.07 FACILITY OPERATIONS AND WORK SEQUENCE

A. Continuous operation of Owner's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of Owner's operations.

C. Provide safe access to Owner's existing facilities, including access for:

1. Biosolids trucks.
2. Chemical deliveries (including polymer and lime, hypochlorite, and bisulfite).
3. Garbage pickup.
4. Grit and screenings hauling.

D. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and heating, access, and similar items to maintain continuous operations of Owner's facility.

E. Do not close pipes, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

F. Work Sequence:

1. To meet the overall objectives of the Project, certain tasks and task elements should be generally performed, completed, or substantially completed in the herein-specified sequences. However, two or more of the tasks or task elements may be pursued simultaneously when consistent with the requirements specified herein; the requirements of Article Project Milestones, Article General Work Sequencing Constraints, Paragraph Removal from Service (RFS) and Facility Shutdown, and the Project Schedule.
2. The specified sequences and tasks are not all-inclusive. They are intended to convey overall constraints and suggested construction sequences. The Contractor shall plan the Work, relocate facilities, reroute utilities, and provide for temporary connections and terminations

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as necessary in an appropriate sequence of operation to perform the Work, while minimizing interferences with and providing for continuous operation of the Owner's existing wastewater facilities.

3. Task headings and descriptions set forth below are descriptive only and are not intended to define the scope of Work included therein.
4. Major tasks and sequences have been identified for the Owner's purposes. Although all Work is not listed herein, the tasks listed shall be understood to include all accompanying tasks such as, but not limited to, sitework, interconnecting utilities associated infrastructure, and applicable temporary provisions necessary to sequence the Work. Temporary provisions shall include pipeline endcaps, other utility terminations, and temporary utilities as necessary to allow operation of portions of the Work prior to completion of other portions of the Work, consistent with the Contractor's sequence of operations, although such provisions are not shown.
5. All existing Owner facilities shall remain in continuous operation except as specified herein.
6. Required Constraints and Suggested Task Sequencing:
    a. Initial Sitework:
        1) Install erosion control measures.
        2) Install staging areas, separate Contractor entrance gates, and other site security measures.
        3) Relocate existing utilities as shown and specified.
    b. Primary Clarifier Rehabilitation (each pair of clarifiers):
        1) Coordinate with Owner for removal from service.
        2) Install temporary, and quickly removable bulkheads in primary influent channel to isolate and allow Contractor dewatering of channel.
        3) Demolish existing longitudinal and cross sludge collector mechanisms, piping, and other facilities as shown and specified.
        4) Clean and prepare concrete surfaces for rehabilitation.
        5) Perform crack repair, controlled concrete surface rehabilitation, and concrete repair, concrete joint repair.
        6) Install new piping and pipe supports.
        7) Install new longitudinal and cross sludge collector mechanisms and scum skimmer mechanisms.
        8) Perform Functional Testing Part 1 for all new equipment (see Section 40 90 00, Instrumentation and Control for Process Systems).

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9) Provide support for Integrator of Record Software Testing and perform Functional Testing Part 2 (see Section 40 90 00, Instrumentation and Control for Process Systems).
   a) The startup (including Functional Testing Part 2) of the primary clarifiers should be based on PLC program areas (listed below). An entire PLC program area shall be started up simultaneously (since these systems are tied together), but not at the same time as another PLC program area.
      (1) Primary Clarifier PLC Area:
         (a) Sludge collector mechanisms.
         (b) Scum skimmer mechanisms.
         (c) Gas detection instrumentation and go/no-go lighting.
   b) Electrical and I&C Considerations for Primary Clarifiers and Related Facilities: Modifications of existing circuits require close coordination with Owner, documentation of removal from service request, and may require temporary power.
   c) Once rehabilitated primary clarifiers meet Substantial Completion requirements, the Owner will operate those facilities.

c. Electrical Panels and Circuits: Replacement of corroded electrical cabinet, conduits, and circuits may occur at any time subject to other specified constraints.

G. Site Electrical System:

1. Performance of Site electrical improvements requires a sequence of activities to facilitate process needs and promote safe operation of the facility. The following general sequence of work shall be incorporated into the Project Schedule, and draft Facility Startup and Performance Demonstration plan, specified in Section 01 91 14, Equipment Testing and Facility Startup. The duration of these specific activities shall be reflected in the Project Schedule.
2. Temporary Generator Requirements:
   a. Provide temporary generators when specified, and whenever power is interrupted unless otherwise specified.
   b. Temporary generators shall be diesel engine driven, 480 V, three-phase, 60 Hz, with automatic transfer switch and telemetry controls.

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c. Provide alarms for at least the following conditions:
   1) Fail to start.
   2) Low coolant temperature (indicator of block heater failure).
   3) Low oil pressure.
   4) High jacket water temperature.
   5) Engine overspeed.
   6) Low/high dc voltage.
   7) Low coolant level.
   8) Low fuel level.
   9) Low battery voltage.
   10) High battery voltage.
   11) Battery charger failure.

d. Provide 24 hour per day, 7 days per week attendant, with on-call connection to generator telemetry system, and with 15-minute response time to site for all generator alarms during periods when generators are in use, or serving in backup power function.

e. Generators shall be “whisper quiet” electrical generators, capable of meeting night-time City of Oregon City residential noise ordinance criteria. Additional sound attenuation enclosures may be required with use of commercially available generators to achieve noise ordinance criteria. Consider operational constraints during extreme hot and cold temperatures and protect temporary systems from damage due to environmental exposure. Contractor shall be responsible for operation of these generators.

f. Submit temporary power plans to Engineer within 30 days of Notice to Proceed, and no later than 45 days prior to performing Work that requires temporary power. Failure to submit as specified may be considered grounds for nonpayment of progress payments due until such submittal is satisfactorily submitted. All temporary power plans shall be subject to Engineer approval and Engineer may require modifications to Contractor’s plans to comply with the above requirements.

g. Prior to putting into service operate for 3-hour system performance test under actual operating conditions. System shall not fail during this period.

h. Test systems (load not required) by simulating “loss of power” signal and automatically starting all temporary generators and running them on recurring basis for manufacturer’s recommended system test duration, or 15 minutes minimum if manufacturer has no recommendation. Test weekly, at time acceptable to Owner (assume noon, each Wednesday unless otherwise requested by Owner).

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H. Removal from Service (RFS) and Facility Shutdown:

1. Unless indicated otherwise herein, removal from service (RFS) of existing treatment processes, facilities, or services (including connection of existing pipelines, electrical systems, or structures) shall be coordinated with the Owner and Engineer through a written RFS plan. RFS plans shall be submitted sufficiently in advance of the RFS period (minimum of 2 weeks) and in appropriate detail to be reviewed and approved in a dedicated meeting a minimum of 2 days prior to the requested RFS date. The RFS plan shall include the purpose, procedures and schedules for shutdown and startup of the subject process, facilities, or service, and emergency procedures and appropriate staffing levels for prevention of an extended shutdown period.
2. Contractor shall include the discussion of all current and expected RFS plans as part of the weekly construction meeting.
3. All diversions and shutdowns to plant flows and processes shall be subject to actual process, flow, and weather conditions existing at the time of the requested RFS. Owner's determination regarding the acceptability of proceeding with a planned RFS shall be final.
4. In addition to the RFS plan, incorporate the following constraints regarding plant flow manipulation, duration, and/or time of year:
    a. Shutdowns shall be scheduled for weekdays when Owner's operations personnel are present during their normal day shift working hours (Mondays through Thursdays).
    b. Potable (City) Water (W1), Non-Potable City Water, (W2), and Plant (Treated Effluent) Water (W3, W4, W5, W6): The maximum shutdown period is 2 hours. Plant staff will determine the time of day, and day of the week (Monday through Friday) that shutdown is acceptable. To maintain acceptable plant operation and fire protection, only one of these services may be shut down at a time.
    c. Raw Wastewater (Headworks Flows), Primary Influent and Primary Effluent (PI and PE): No shutdowns permitted.
    d. Primary Sludge and Scum (PS and SC): The maximum shutdown period is 4 hours.
5. Instrument Air and Service Air (AI and AS): The Maximum Shutdown Period is 2 hours. Plant staff will determine the time of day that shutdown is acceptable.
6. Power outages will be through the RFS process, with a minimum 2-week notice. Describe the reason, anticipated length of time, and areas affected by the outage. Provide temporary provisions for continuous power supply to critical facility components.
    a. Anticipated power outages and durations for major electrical modifications are as specified in this section.

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I. Do not proceed with Work affecting a facility's operation without obtaining Owner's and Engineer's advance approval of the need for and duration of such Work.

J. Relocation of Existing Facilities:

1. During construction, it is expected that minor relocations of Work will be necessary.
2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
4. Perform relocations to minimize downtime of existing facilities.
5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

1.08 ADJACENT FACILITIES AND PROPERTIES

A. Examination:

1. After Effective Date of the Agreement and before Work at Site is started, Contractor, Engineer, and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections in accordance with Article Construction Photographs and Article Audio-Video Recordings.
2. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor's operations, and is for the protection of adjacent property owners, Contractor, and Owner.

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1.09 CONSTRUCTION PHOTOGRAPHS

A. General:

1. Photographically document all phases of the Project including preconstruction, construction progress, and post-construction.
2. Engineer shall have right to select subject matter and vantage point from which photographs are to be taken.
3. Digital Images: No post-session electronic editing of images is allowed. Stored image shall be actual image as captured without cropping or other edits.

B. Preconstruction and Post-Construction:

1. After Effective Date of the Agreement and before Work at Site is started, and again upon issuance of Substantial Completion, take photographs of Site and property adjacent to perimeter of Site.
2. Format: Digital, minimum resolution of 1,680 pixels by 2,240 pixels and 24-bit, millions of color.

C. Construction Progress Photos:

1. Photographically demonstrate progress of construction, showing every aspect of Site and adjacent properties as well as interior and exterior of new or impacted structures.
2. Weekly: Take photographs using digital, minimum resolution of 1,680 pixels by 2,240 pixels and 24-bit, millions of color.
3. Monthly: Take photographs using digital, minimum resolution of 1,680 pixels by 2,240 pixels and 24-bit, millions of color.

D. Documentation:

1. Digital Images:
   a. Electronic image shall have date taken embedded into image.
   b. Archive using a commercially available photo management system that provides listing of photographs, including date, keyword description, and direction of photograph.
   c. Label file folders or database records with Project and Owner’s name, and month and year images were produced.

1.10 AUDIO-VIDEO RECORDINGS

A. Prior to beginning the Work on Site or of a particular area of the Work, and again within 10 days following date of Substantial Completion, videograph Site and property adjacent to Site.

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B. In the case of preconstruction recording, no work shall begin in the area prior to Engineer's review and approval of content and quality of video for that area.

C. Particular emphasis shall be directed to physical condition of existing vegetation, structures, and pavements within Project area and areas adjacent to and within the right-of-way or easement, and on Contractor storage and staging areas.

D. Engineer shall have right to select subject matter and vantage point from which videos are to be taken.

E. Video Format and Quality:

1. Digital Mp4 format on DVD, with sound.
2. Video:
    a. Produce bright, sharp, and clear images with accurate colors, free of distortion and other forms of picture imperfections.
    b. Electronically, and accurately display the month, day, year, and time of day of the recording.
3. Audio:
    a. Audio documentation shall be done clearly, precisely, and at a moderate pace.
    b. Indicate date, project name, and a brief description of the location of recording, including:
        1) Facility name.
        2) Street names or easements.
        3) Addresses of private property.
        4) Direction of coverage, including engineering stationing, if applicable.

F. Documentation:

1. DVD Label:
    a. DVD number (numbered sequentially, beginning with 001).
    b. Project name.
2. Date and time of coverage.
3. Project Video Log: Maintain an ongoing log that incorporates above noted label information for DVDs on Project.

1.11 REFERENCE POINTS AND SURVEYS

A. Location and elevation of benchmarks are shown on Drawings.

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B. Contractor's Responsibilities:

1. Provide survey and layout required to layout the Work.
2. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
3. Retain professional land surveyor or civil engineer registered in state of Project who shall perform or supervise engineering surveying necessary for additional construction staking and layout.
4. Maintain complete accurate log of survey work as it progresses as a Record Document.
5. On request of Engineer, submit documentation.
6. Provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to:
    a. Establish control points, lines, and easement boundaries.
    b. Check layout, survey, and measurement work performed by others.
    c. Measure quantities for payment purposes.

1.12 ELECTRONIC DOCUMENT MANAGEMENT SYSTEM

A. The Owner and Contractor shall utilize an Owner provided electronic document management system (EDMS) similar to ProjectWise Construction Management, Procore, "or-equal," for electronic submittal of all data and documents throughout the duration of the Contract. The Owner furnished EDMS will be made available to all Contractors' Project personnel, subcontractor personnel, suppliers, consultants and the Designer of Record. The joint use of this system is to facilitate, electronic exchange of information, automation of key processes, and overall management of the Contract. The EDMS shall be the primary means of Project information submission and management. When required by the Owners representative, paper documents will also be provided. In the event of discrepancy between the electronic version and paper documents the paper documents will govern. ProjectWise Construction Management is a registered trademark of Bentley Systems, Incorporated.

B. User Access Limitations:

1. The Owner's Representative will control the Contractor's access to the EDMS by allowing access and assigning user profiles to accepted Contractor personnel. User profiles will define levels of access into the system, determine assigned function-based authorizations (determines what can be seen), and user privileges (determines what they can do). Subcontractors and suppliers will be given access to the EDMS through the Contractor. Entry of information exchanged and transferred between

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the Contractor and its subcontractors and suppliers on the EDMS shall be the responsibility of the Contractor.

2. Joint Ownership of Data: Data entered in a collaborative mode (entered with the intent to share as determined by permissions and workflows within the EDMS) by the Owner's Representative and the Contractor will be jointly owned.

C. Automated System Notification and Audit Log Tracking: Review comments made (or lack thereof) by the Owner on Contractor submitted documentation shall not relieve the Contractor from compliance with requirements of the Contract Documents. The Contractor is responsible for managing, tracking, and documenting the Work to comply with the requirements of the Contract Documents. Owner's acceptance via automated system notifications or audit logs extends only to the face value of the submitted documentation and does not constitute validation of the Contractor's submitted information.

D. Submittals: See Section 01 33 00, Submittal Procedures.

E. Computer Requirements: The Contractor shall use computer hardware and software that meets the requirements of the Owner furnished EDMS as recommended by the EDMS supplier, to access and utilize the EDMS. As recommendations are modified by the EDMS supplier, the Contractor will upgrade their system(s) to meet the recommendations or better. Upgrading of the Contractor's computer systems will not be justification for a cost or time modification to the Contract. The Contractor will ensure that connectivity to the EDMS (whether at the home office or jobsite) is accomplished through DSL, cable, T-l, or wireless communications systems. The minimum bandwidth requirements for using the system is 128 kb per second. It is recommended a faster connection be used when uploading pictures and files into the system. The EDMS is expected to support commonly available web browsers for accessing the application.

F. Contractor Responsibility: The Contractor shall be responsible for the validity of their information placed in the EDMS and for the abilities of their personnel. Accepted users shall be knowledgeable in the use of computers, including Internet browsers, email programs, CAD drawing applications, and Adobe Portable Document Format (PDF) document distribution program. The Contractor shall utilize the existing forms in the EDMS to the maximum extent possible. If a form does not exist in the EDMS, the Contractor must include a form of their own or provided by the Owner's Representative as an attachment to a submittal. Adobe PDF documents will be created through electronic conversion rather than optically scanned whenever possible. The Contractor is responsible for the training of their personnel in the use of the

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EDMS (outside what is provided by the Owner), and the other programs indicated above as needed.

G. User Access Administration: Provide a list of Contractor's key EDMS personnel for the Owner's Representative acceptance. Contractor is responsible for adding and removing users from the system. The Owner's Representative reserves the right to perform a security check on all potential users. The Contractor will be allowed to add additional personnel and subcontractors to the EDMS.

H. Connectivity Problems: The EDMS is subject to the inherent speed and connectivity problems of the Internet. The Contractor is responsible for its own connectivity to the Internet. The EDMS response time is dependent on the Contractor's equipment, including processor speed, Internet access speed, etc., and current traffic on the Internet. The Owner will not be liable for any delays associated from the usage of the EDMS including, but not limited to slow response time, downtime periods, connectivity problems, or loss of information. The Contractor will ensure that connectivity to the EDMS (whether at the home office or jobsite) is accomplished through DSL, cable, T-l, or wireless communications systems. Under no circumstances shall the usage, of the EDMS be grounds for a time extension or cost adjustment to the Contract.

I. Training:

1. The Project Owner has arranged for the following training to be provided to the Contractor:
   a. Up to two training sessions will be offered for Contractor and Subcontractor personnel to be coordinated at a time arranged by Contractor with Owner's Representative within 21 days of Notice to Proceed. Contractor participation in training is strongly encouraged and shall be considered incidental to the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SALVAGE OF MATERIALS

A. Materials to be salvaged include:

1. None.

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3.02 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

B. Obtain prior written authorization of Engineer before commencing Work to cut or otherwise alter:

1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
2. Weather-resistant or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Work of others.

C. Refinish surfaces to provide an even finish.

1. Refinish continuous surfaces to nearest intersection.
2. Refinish entire assemblies.
3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and the Work is evident in finished surfaces.

D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown on Drawings.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

G. Remove specimens of installed Work for testing when requested by Engineer.

3.03 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is part of this specification.

1. Removal from Service Form.

END OF SECTION

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Jacobs *Removal from Service Form*

Number:

ACTIVITY: Date:

PROJECT: WES PROJECT NO:

Contractor: Trades involved: Requested by:

Target Start Date: Duration:

Regarding Drawing No. Spec. Section: Schedule:

The following work has been identified which will impact normal plant operations: (attach work procedures, systems affected, additional information, or drawings as necessary to fully describe work and impact)

<add information on additional pages as required>

Submitted by Contractor: Date:

Review Comments:

Reviewed By Engineer: Date:

Will work require initiation of Startup and Commissioning Checklist and Approval Sheet? **Yes** ☐ **No** ☐

Could this RFS Activity cause an odor release? **Yes** ☐ **No** ☐

(if yes, then notify Engineer and Owner prior to commencing activity)

Does work impact any of the following systems? If so, attach completed and approved Change Worksheet. Digester Gas ☐ Digester Solids ☐ N/A ☐

District Review Disposition:		Approved	Approved as Noted	Disapproved	N/A
		☐	☐	☐	☐
HVAC	Date	☐	☐	☐	☐
Instrumentation and Data	Date	☐	☐	☐	☐
Lab	Date	☐	☐	☐	☐
Maintenance	Date	☐	☐	☐	☐
Operations	Date	☐	☐	☐	☐
Administration	Date	☐	☐	☐	☐
Plant Engineer	Date	☐	☐	☐	☐
Safety Captain	Date				

Pre-Start Meeting ☐ Proceed? ☐ YES ☐ NO

LO/TO Complete ☐ Proceed? ☐ YES ☐ NO

Activity:

Description of work

Location

Target Date and Time

Key Personnel

Activities Prior to the work.

Work Activities

Owner Involvement

Special Considerations

_____ Date

<Contractor Representative Name >Signature ; <Firm>

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 GENERAL

A. Engineer will schedule physical arrangements for meetings throughout progress of the Work, prepare meeting agenda with regular participant input and distribute with written notice of each meeting, preside at meetings, record minutes to include significant proceedings and decisions, and reproduce and distribute copies of minutes within 5 days after each meeting to participants and parties affected by meeting decisions.

1.02 PARTNERING MEETINGS

A. Attend and participate in partnering meetings as specified.

1.03 PRECONSTRUCTION CONFERENCE

A. Contractor shall be prepared to discuss and present data on the following subjects, as a minimum:

1. Required schedules.
2. Preliminary Schedule of Submittals including dates for major submittals (temporary facilities and controls submittals; HVAC equipment, electrical local control panels and motor control center starter units; instrumentation and control components; Division 44, Pollution and Waste Control Equipment, equipment; at minimum).
3. Schedule of Values.
4. First 60 days plan of operation and construction.
5. Safety Plan.
6. Status of Bonds and insurance.
7. Sequencing of critical path work items.
8. Progress payment procedures.
9. Project changes and clarification procedures.
10. Use of Site, access, office and storage areas, security, and temporary facilities.
11. Major product delivery and priorities.
12. Contractor’s safety plan and representative.

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B. Attendees will include:

1. Owner’s representatives.
2. Contractor’s office representative.
3. Contractor’s resident superintendent.
4. Contractor’s quality control representative.
5. Subcontractors’ representatives whom Contractor may desire, or Engineer may request to attend.
6. Engineer’s representatives.
7. Others as appropriate.

1.04 PRELIMINARY SCHEDULES REVIEW MEETING

A. As set forth in General Conditions and Section 01 32 00, Construction Progress Documentation.

1.05 PROGRESS MEETINGS

A. Engineer will schedule regular progress meetings at Site, conducted weekly to review the Work progress, Progress Schedule, Schedule of Submittals, 3 week look ahead schedule, Application for Payment, contract modifications, and other matters needing discussion and resolution.

B. Attendees will include:

1. Owner’s representative(s), as appropriate.
2. Contractor, Subcontractors, and Suppliers, as appropriate and as requested by the Owner.
3. Engineer’s representative(s).
4. Others as appropriate and as requested by the Owner.

1.06 QUALITY CONTROL MEETINGS

A. In accordance with Section 01 45 16.13, Contractor Quality Control.

B. Scheduled by Engineer on regular basis and as necessary to review test and inspection reports, and other matters relating to quality control of the Work and work of other Contractors.

C. Attendees will include:

1. Contractor.
2. Contractor’s designated quality control representative.
3. Subcontractors and Suppliers, as necessary.
4. Engineer’s representatives.

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1.07 PROCESS INSTRUMENTATION AND CONTROL SYSTEMS (PICS) COORDINATION MEETINGS

A. Engineer will schedule meetings at Site, conducted monthly to review specific requirements of PICS work.

B. Attendees will include:

1. Contractor.
2. Owner.
3. Owner’s Integrator of Record.
4. PICS Subcontractor/Installer.
5. Engineer’s representatives.

1.08 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene at Site prior to commencing the Work of that section.

B. Require attendance of entities directly affecting, or affected by, the Work of that section.

C. Notify Engineer 4 days in advance of meeting date.

D. Provide suggested agenda to Engineer to include reviewing conditions of installation, preparation and installation or application procedures, and coordination with related Work and work of others.

1.09 FACILITY STARTUP MEETINGS

A. Schedule and attend a minimum facility startup meetings.

1. The first of such meetings shall be held prior to submitting Facility Startup Plan, as specified in Section 01 91 14, Equipment Testing and Facility Startup, and shall include preliminary discussions regarding such plan.
2. Weekly meetings starting 2 months prior to the startup of: All new equipment.

B. Agenda items shall include, but not be limited to, content of Facility Startup Plan, coordination needed between various parties in attendance, and potential problems associated with startup.

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C. Attendees will include:

1. Contractor.
2. Contractor's designated quality control representative.
3. Subcontractors and equipment manufacturer's representatives whom Contractor deems to be directly involved in facility startup.
4. Engineer's representatives.
5. Owner's operations personnel.
6. Owner's Integrator of Record.
7. Others as required by Contract Documents or as deemed necessary by Contractor.

1.10 OTHER MEETINGS

A. In accordance with Contract Documents and as may be required by Owner and Engineer.

1.11 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this specification.

1. Site Specific Safety Plan Certification.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SITE SPECIFIC SAFETY PLAN CERTIFICATION

Contractor performs all operations in strict accordance with all applicable standards set by Oregon Occupational Safety and Health Division (OR-OSHA), including, but not limited to Oregon Administrative Rules (OAR) 437, Chapter 2, Sections 141 – 147 (29 CFR Part 1910, 29 CFR Part 1926).

Contractor creates and maintains a Site-Specific Safety Plan, which is require on-site through the entirety of the project. The Contractor's Safety Manager is trained and knowledgeable in all safety requirements and shall be responsible for the compliance with all applicable safety requirements. All job personnel are knowledgeable of and comply with the Site Specific Safety Plan requirements.

The Site-Specific Safety Plan includes the following basic elements:

- Policy or goals statement
- List of responsible persons, including 24 hour contact information
- Hazard identification and assessment (Job Hazard Analysis)
- Hazard controls and safe practices
- Emergency and accident response
- Confined Space Entry Plan, including the Rescue Plan
- Emergency Spill Response Plan
- Pollution Control Plan
- Employee training and communication
- Recordkeeping

Contractor acknowledges that they are solely and completely responsible for the safety of the construction site, including, but not limited to, the safety of all persons and property present at the site at any time until final completion and acceptance by District.

I, _____ (the undersigned Contractor), affirm that I comply with the above information.

_____
Name of Firm

_____
Signature

_____
Printed Name

_____
Title

SECTION 01 32 00
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Preliminary Progress Schedule: Submit within time specified in Paragraph 2.03 of the General Conditions.
2. Detailed Progress Schedule:
   a. Submit initial Detailed Progress Schedule within 60 days after Effective Date of the Agreement.
   b. Submit an Updated Progress Schedule at each update, in accordance with Article Detailed Progress Schedule.
3. Submit with Each Progress Schedule Submission:
   a. Contractor's certification that Progress Schedule submission is actual schedule being used for execution of the Work.
   b. Electronic file compatible with latest version of Microsoft Project by Microsoft Corporation.
   c. Progress Schedule: Two legible copies (PDF format).
   d. Narrative Progress Report: Same number of copies as specified for Progress Schedule.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PRELIMINARY PROGRESS SCHEDULE

A. In addition to basic requirements outlined in General Conditions, show a detailed schedule, beginning with Notice to Proceed, for minimum duration of 120 days, and a summary of balance of Project through Final Completion.

B. Show activities including, but not limited to the following:

1. Notice to Proceed.
2. Permits.
3. Submittals, with review time. Contractor may use Schedule of Submittals specified in Section 01 33 00, Submittal Procedures.
4. Early procurement activities for long lead equipment and materials.
5. Initial Site work.
6. Earthwork.
7. Specified Work sequences and construction constraints.
8. Contract Milestone and Completion Dates.
9. Owner-furnished products delivery dates or ranges of dates.

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10. Major structural, mechanical, equipment, electrical, architectural, and instrumentation and control Work.
11. System startup summary.
12. Project close-out summary.
13. Demobilization summary.

C. Update Preliminary Progress Schedule monthly as part of progress payment process. Failure to do so may result in the Owner withholding all or part of the monthly progress payment until the Preliminary Progress Schedule is updated in a manner acceptable to Engineer.

D. Format: In accordance with Article Progress Schedule—Critical Path Network.

1.03 DETAILED PROGRESS SCHEDULE

A. In addition to requirements of General Conditions, submit Detailed Progress Schedule beginning with Notice to Proceed and continuing through Final Completion.

B. Show the duration and sequences of activities required for complete performance of the Work reflecting means and methods chosen by Contractor.

C. When accepted by Engineer, Detailed Progress Schedule will replace Preliminary Progress Schedule and become Baseline Schedule. Subsequent revisions will be considered as Updated Progress Schedules.

D. Format: In accordance with Article Progress Schedule—Critical Path Network.

E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.04 PROGRESS SCHEDULE—CRITICAL PATH NETWORK

A. General: Comprehensive computer-generated schedule using CPM, generally as outlined in Associated General Contractors of America (AGC) 580, “Construction Project Planning and Scheduling Guidelines.” If a conflict occurs between the AGC publication and this Specification, this Specification shall govern.

B. Contents:

1. Schedule shall begin with the date of Notice to Proceed and conclude with the date of Final Completion.

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2. Identify Work calendar basis using days as a unit of measure.
3. Show complete interdependence and sequence of construction and Project-related activities reasonably required to complete the Work.
4. Identify the Work of separate stages and other logically grouped activities, and clearly identify critical path of activities.
5. Reflect sequences of the Work, restraints, delivery windows, review times, Contract Times and Project Milestones set forth in the Agreement and Section 01 31 13, Project Coordination.
6. Include as applicable, at a minimum:
    a. Obtaining permits, submittals for early product procurement, and long lead time items.
    b. Mobilization and other preliminary activities.
    c. Initial Site work.
    d. Specified Work sequences, constraints, and Milestones, including Substantial Completion date(s) Subcontract Work.
    e. Major equipment design, fabrication, factory testing, and delivery dates.
    f. Delivery dates for Owner-furnished products (if any), as specified in Section 01 11 00, Summary of Work.
    g. Sitework.
    h. Concrete Work.
    i. Structural steel Work.
    j. Architectural features Work.
    k. Conveying systems Work.
    l. Equipment Work.
    m. Mechanical Work.
    n. Electrical Work.
    o. Instrumentation and control Work.
    p. Interfaces with Owner-furnished equipment (if any).
    q. Other important Work for each major facility.
    r. Equipment and system startup and test activities.
    s. Project closeout and cleanup.
    t. Demobilization.
7. No activity duration, exclusive of those for Submittals review and product fabrication/delivery, shall be less than 1 day nor more than 30 days, unless otherwise approved.
8. Activity duration for Submittal review shall not be less than review time specified unless clearly identified and prior written acceptance has been obtained from Engineer.

C. Network Graphical Display:

1. Plot or print on paper not greater than 30 inches by 42 inches or smaller than 22 inches by 34 inches, unless otherwise approved.

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2. Title Block: Show name of Project, Owner, date submitted, revision or update number, and the name of the scheduler. Updated schedules shall indicate data date.
3. Identify horizontally across top of schedule the time frame by year, month, and day.
4. Identify each activity with a unique number and a brief description of the Work associated with that activity.
5. Indicate the critical path.
6. Show, at a minimum, the controlling relationships between activities.
7. Plot activities on a time-scaled basis, with the length of each activity proportional to the current estimate of the duration.
8. Plot activities on an early start basis unless otherwise requested by Engineer.
9. Provide a legend to describe standard and special symbols used.

D. Schedule Report:

1. On 8-1/2-inch by 11-inch white paper, unless otherwise approved.
2. List information for each activity in tabular format, including at a minimum:
   a. Activity Identification Number.
   b. Activity Description.
   c. Original Duration.
   d. Remaining Duration.
   e. Early Start Date (Actual start on Updated Progress Schedules).
   f. Early Finish Date (Actual finish on Updated Progress Schedules).
   g. Late Start Date.
   h. Late Finish Date.
   i. Total Float.
3. Sort reports, in ascending order, as listed below:
   a. Activity number sequence with predecessor and successor activity.
   b. Activity number sequence.
   c. Early-start.
   d. Total float.

E. Cost-Loading:

1. Note the estimated cost to perform each Work activity, with the exception of Submittals or Submittal reviews, in the network in a tabular listing.

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2. The sum of all activity costs shall equal the Contract Price. An unbalanced or front-end-loaded schedule will not be acceptable.
3. The accepted cost-loaded Progress Schedule shall constitute the Schedule of Values.

1.05 PROGRESS OF THE WORK

A. Updated Progress Schedule shall reflect:

1. Progress of Work to within 5 working days prior to submission.
2. Approved changes in Work scope and activities modified since submission.
3. Delays in Submittals or resubmittals, deliveries, or Work.
4. Adjusted or modified sequences of Work.
5. Other identifiable changes.
6. Revised projections of progress and completion.
7. Report of changed logic.

B. Produce detailed subschedules during Project, upon request of Owner or Engineer, to further define critical portions of the Work such as facility shutdowns.

C. If an activity is not completed by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), submit, within 7 days of such failure, a written statement as to how nonperformance will be corrected to return Project to acceptable current Progress Schedule. Actions by Contractor to complete the Work within Contract Times (or Milestones) will not be justification for adjustment to Contract Price or Contract Times.

D. Owner may order Contractor to increase plant, equipment, labor force, or working hours if Contractor fails to:

1. Complete a Milestone activity by its completion date.
2. Satisfactorily execute Work as necessary to prevent delay to overall completion of Project, at no additional cost to Owner.

1.06 NARRATIVE PROGRESS REPORT

A. Format:

1. Organize same as Progress Schedule.
2. Identify, on a cover letter, reporting period, date submitted, and name of author of report.

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B. Contents:

1. Number of days worked over the period, work force on hand, construction equipment on hand (including utility vehicles such as pickup trucks, maintenance vehicles, stake trucks).
2. General progress of Work, including a listing of activities started and completed over the reporting period, mobilization/demobilization of subcontractors, and major milestones achieved.
3. Contractor's plan for management of Site (for example, lay down and staging areas, construction traffic), use of construction equipment, buildup of trade labor, and identification of potential Contract changes.
4. Identification of new activities and sequences as a result of executed Contract changes.
5. Documentation of weather conditions over the reporting period, and any resulting impacts to the work.
6. Description of actual or potential delays, including related causes, and the steps taken or anticipated to mitigate their impact.
7. Changes to activity logic.
8. Changes to the critical path.
9. Identification of, and accompanying reason for, any activities added or deleted since the last report.
10. Steps taken to recover the schedule from Contractor-caused delays.

1.07 SCHEDULE ACCEPTANCE

A. Engineer's acceptance will demonstrate agreement that:

1. Proposed schedule is accepted with respect to:
   a. Contract Times, including Final Completion and all intermediate Milestones, are within the specified times.
   b. Specified Work sequences and constraints are shown as specified.
   c. Specified Owner-furnished Equipment or Material arrival dates, or range of dates, are included.
   d. Access restrictions are accurately reflected.
   e. Startup and testing times are as specified.
   f. Submittal review times are as specified.
   g. Startup testing duration is as specified, and timing is acceptable.
2. In all other respects, Engineer's acceptance of Contractor's schedule indicates that, in Engineer's judgment, schedule represents reasonable plan for constructing Project in accordance with the Contract Documents. Engineer's review will not make any change in Contract requirements. Lack of comment on any aspect of schedule that is not in accordance with the Contract Documents will not thereby indicate acceptance of that change, unless Contractor has explicitly called the

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nonconformance to Engineer's attention in submittal. Schedule remains Contractor's responsibility and Contractor retains responsibility for performing all activities, for activity durations, and for activity sequences required to construct Project in accordance with the Contract Documents.

B. Unacceptable Preliminary Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process, including updating schedule on a monthly basis to reflect actual progress and occurrences to date.

C. Unacceptable Detailed Progress Schedule:

1. Make requested corrections; resubmit within 10 days.
2. Until acceptable to Engineer as Baseline Progress Schedule, continue review and revision process.

D. Narrative Report: All changes to activity duration and sequences, including addition or deletion of activities subsequent to Engineer's acceptance of Baseline Progress Schedule, shall be delineated in Narrative Report current with proposed Updated Progress Schedule.

1.08 ADJUSTMENT OF CONTRACT TIMES

A. Reference General Conditions.

B. Evaluation and reconciliation of Adjustments of Contract Times shall be based on the Updated Progress Schedule at the time of proposed adjustment or claimed delay.

C. Float:

1. Float time is a Project resource available to both parties to meet contract Milestones and Contract Times.
2. Use of float suppression techniques such as preferential sequencing or logic, special lead/lag logic restraints, and extended activity times are prohibited, and use of float time disclosed or implied by use of alternate float-suppression techniques shall be shared to proportionate benefit of Owner and Contractor.
3. Pursuant to above float-sharing requirement, no time extensions will be granted nor delay damages paid until a delay occurs which (i) impacts Project's critical path, (ii) consumes available float or contingency time, and (iii) extends Work beyond contract completion date.

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D. Claims Based on Contract Times:

1. Where Engineer has not yet rendered formal decision on Contractor's Claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in Progress Schedule, reflect an interim adjustment in the Progress Schedule as acceptable to Engineer.
2. It is understood and agreed that such interim acceptance will not be binding on either Contractor or Owner, and will be made only for the purpose of continuing to schedule Work until such time as formal decision has been rendered as to an adjustment, if any, of the Contract Times.
3. Revise Progress Schedule prepared thereafter in accordance with Engineer's formal decision.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 DEFINITIONS

A. Action Submittal: Written and graphic information submitted by Contractor that requires Engineer's approval.

B. Deferred Submittal: Information in accordance with 2018 IBC Section 107.3.4.1 submitted by Contractor for portions of design that are to be submitted to permitting agency for approval prior to installation of that portion of the Work, along with Engineer's review documentation that submittal has been found to be in general conformance with Project's design.

C. Informational Submittal: Information submitted by Contractor that requires Engineer's review and determination that submitted information is in accordance with the Conditions of the Contract.

1.02 PROCEDURES

A. Direct submittals to Engineer at the following, unless specified otherwise.

1. Submit via Owner furnished electronic document management system (EDMS) software. See Section 01 31 13, Project Coordination, for description of the EDMS software and required use.

B. Electronic Submittals: Submittals shall, unless specifically accepted, be made in electronic format.

1. Each submittal shall be an electronic file in Adobe Acrobat Portable Document Format (PDF). Use the latest version available at time of execution of the Agreement.
2. Electronic files that contain more than 10 pages in PDF format shall contain internal bookmarking from an index page to major sections of the document.
3. PDF files shall be set to open "Bookmarks and Page" view.
4. Add general information to each PDF file, including title, subject, author, and keywords.
5. PDF files shall be set up to print legibly at 8.5-inch by 11-inch, 11-inch by 17-inch, or 22-inch by 34-inch. No other paper sizes will be accepted.
6. Submit new electronic files for each resubmittal.

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7. Include a copy of the Transmittal of Contractor's Submittal form, located at end of section, with each electronic file.
8. Engineer will reject submittal that is not electronically submitted, unless specifically accepted.
9. Provide Engineer with authorization to reproduce and distribute each file as many times as necessary for Project documentation.
10. Detailed procedures for handling electronic submittals will be discussed at the preconstruction conference.

C. Transmittal of Submittal:

1. Contractor shall:
   a. Review each submittal and check for compliance with Contract Documents.
   b. Stamp each submittal with uniform approval stamp before submitting to Engineer.
      1) Stamp to include Project name, submittal number, Specification number, Contractor's reviewer name, date of Contractor's approval, and statement certifying submittal has been reviewed, checked, and approved for compliance with Contract Documents.
      2) Engineer will not review submittals that do not bear Contractor's approval stamp and will return them without action.
2. Complete, sign, and transmit with each submittal package, one Transmittal of Contractor's Submittal form attached at end of this section.
3. Identify each submittal with the following:
   a. Numbering and Tracking System:
      1) Sequentially number each submittal.
      2) Resubmission of submittal shall have original number with sequential alphabetic suffix.
   b. Specification section and paragraph to which submittal applies.
   c. Project title and Engineer's project number.
   d. Date of transmittal.
   e. Names of Contractor, Subcontractor or Supplier, and manufacturer as appropriate.
4. Identify and describe each deviation or variation from Contract Documents.

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D. Format:

1. Do not base Shop Drawings on reproductions of Contract Documents.
2. Package submittal information by individual specification section. Do not combine different specification sections together in submittal package, unless otherwise directed in specification.
3. Present in a clear and thorough manner and in sufficient detail to show kind, size, arrangement, and function of components, materials, and devices, and compliance with Contract Documents.
4. Index with labeled tab dividers in orderly manner.

E. Timeliness: Schedule and submit in accordance Schedule of Submittals, and requirements of individual specification sections.

F. Processing Time:

1. Time for review shall commence on Engineer's receipt of submittal.
2. Engineer will act upon Contractor's submittal and transmit response to Contractor not later than 30 days after receipt, unless otherwise specified.
3. Resubmittals will be subject to same review time.
4. No adjustment of Contract Times or Price will be allowed as a result of delays in progress of Work caused by rejection and subsequent resubmittals.

G. Resubmittals: Clearly identify each correction or change made.

H. Incomplete Submittals:

1. Engineer will return entire submittal for Contractor's revision if preliminary review deems it incomplete.
2. When any of the following are missing, submittal will be deemed incomplete:
    a. Contractor's review stamp; completed and signed.
    b. Transmittal of Contractor's Submittal; completed and signed.
    c. Insufficient number of copies.

I. Submittals not required by Contract Documents:

1. Will not be reviewed and will be returned stamped "Not Subject to Review."
2. Engineer will keep one copy and return submittal to Contractor.

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1.03 ACTION SUBMITTALS

A. Prepare and submit Action Submittals required by individual specification sections.

B. Shop Drawings:

1. Copies: Electronic.
2. Identify and Indicate:
   a. Applicable Contract Drawing and Detail number, products, units and assemblies, and system or equipment identification or tag numbers.
   b. Equipment and Component Title: Identical to title shown on Drawings.
   c. Critical field dimensions and relationships to other critical features of Work. Note dimensions established by field measurement.
   d. Project-specific information drawn accurately to scale.
3. Manufacturer's standard schematic drawings and diagrams as follows:
   a. Modify to delete information that is not applicable to the Work.
   b. Supplement standard information to provide information specifically applicable to the Work.
4. Product Data: Provide as specified in individual specifications.
5. Deferred Submittal: See Drawings for list of deferred submittals.
   a. Contractor-design drawings and product data related to permanent construction.
      1) Written and graphic information.
      2) Drawings.
      3) Cut sheets.
      4) Data sheets.
      5) Action item submittals requested in individual specification section.
   b. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit required supporting data and drawings for review and acceptance by Engineer. Documentation of review and approval provided on Engineer's comment form, along with completed submittal, shall be filed with permitting agency by Contractor and approved by permitting agency prior to installation.
6. Foreign Manufacturers: When proposed, include names and addresses of at least two companies that maintain technical service representatives close to Project.

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C. Samples:

1. Copies: Two, unless otherwise specified in individual specifications.
2. Preparation:
    a. Mount, display, or package Samples in manner specified to facilitate review of quality. Attach label on unexposed side that includes the following:
        1) Manufacturer name.
        2) Model number.
        3) Material.
        4) Sample source.
3. Manufacturer's Color Chart: Units or sections of units showing full range of colors, textures, and patterns available.
4. Full-size Samples:
    a. Size as indicated in individual specification section.
    b. Prepared from same materials to be used for the Work.
    c. Cured and finished in manner specified.
    d. Physically identical with product proposed for use.

D. Action Submittal Dispositions:

1. Engineer will review, comment, stamp, and distribute as noted:
    a. Approved:
        1) Contractor may incorporate product(s) or implement Work covered by submittal.
        2) Distribution: Electronic.
    b. Approved as Noted:
        1) Contractor may incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
        2) Distribution: Electronic.
    c. Partial Approval, Resubmit as Noted:
        1) Make corrections or obtain missing portions, and resubmit.
        2) Except for portions indicated, Contractor may begin to incorporate product(s) or implement Work covered by submittal, in accordance with Engineer's notations.
        3) Distribution: Electronic.
    d. Revise and Resubmit:
        1) Contractor may not incorporate product(s) or implement Work covered by submittal.
        2) Distribution: Electronic.

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1.04 INFORMATIONAL SUBMITTALS

A. General:

1. Copies: Electronic.
2. Refer to individual specification sections for specific submittal requirements.
3. Engineer will review each submittal. If submittal meets conditions of the Contract, Engineer will forward copy to appropriate parties. If Engineer determines submittal does not meet conditions of the Contract and is therefore considered unacceptable, Engineer will return with review comments to Contractor, and require that submittal be corrected and resubmitted.

B. Certificates:

1. General:
   a. Provide notarized statement that includes signature of entity responsible for preparing certification.
   b. Signed by officer or other individual authorized to sign documents on behalf of that entity.
2. Welding: In accordance with individual specification sections.
3. Installer: Prepare written statements on manufacturer's letterhead certifying installer complies with requirements as specified in individual specification section.
4. Material Test: Prepared by qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements.
5. Certificates of Successful Testing or Inspection: Submit when testing or inspection is required by Laws and Regulations or governing agency or specified in individual specification sections.
6. Manufacturer's Certificate of Compliance: In accordance with Section 01 61 00, Common Product Requirements.
7. Manufacturer's Certificate of Proper Installation: In accordance with Section 01 43 33, Manufacturers' Field Services.

C. Construction Photographs and Video: In accordance with Section 01 31 13, Project Coordination, and as may otherwise be required in Contract Documents.

D. Closeout Submittals: In accordance with Section 01 77 00, Closeout Procedures.

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E. Contractor-design Data (related to temporary construction):

1. Written and graphic information.
2. List of assumptions.
3. List of performance and design criteria.
4. Summary of loads or load diagram, if applicable.
5. Calculations.
6. List of applicable codes and regulations.
7. Name and version of software.
8. Information requested in individual specification section.

F. Deferred Submittals: See Drawings for list of deferred submittals.

1. Contractor-design data related to permanent construction:
   a. List of assumptions.
   b. List of performance and design criteria.
   c. Summary of loads or load diagram, if applicable.
   d. Calculations.
   e. List of applicable codes and regulations.
   f. Name and version of design software.
   g. Factory test results.
   h. Informational submittals requested in individual specification section.
2. Prior to installation of indicated structural or nonstructural element, equipment, distribution system, or component or its anchorage, submit calculations and test results of Contractor-designed components for review by Engineer. Documentation of review and indication of compliance with general design intent and Project criteria provided on Engineer's comment form as meets conditions of the Contract, along with completed submittal, shall be filed with permitting agency by Contractor and approved by permitting agency prior to installation.

G. Manufacturer's Instructions: Written or published information that documents manufacturer's recommendations, guidelines, and procedures in accordance with individual specification section.

H. Operation and Maintenance Data: As required in Section 01 78 23, Operation and Maintenance Data.

I. Quality Control Documentation: As required in Section 01 45 16.13, Contractor Quality Control.

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J. Schedules:

1. Schedule of Submittals: Prepare separately or in combination with Progress Schedule as specified in Section 01 32 00, Construction Progress Documentation.
    a. Show for each, at a minimum, the following:
        1) Specification section number.
        2) Identification by numbering and tracking system as specified under Paragraph Transmittal of Submittal.
        3) Estimated date of submission to Engineer, including reviewing and processing time.
    b. On a monthly basis, submit updated Schedule of Submittals to Engineer if changes have occurred or resubmittals are required.
2. Progress Schedules: In accordance with Section 01 32 00, Construction Progress Documentation.

K. Special Guarantee: Supplier's written guarantee as required in individual specification sections.

L. Statement of Qualification: Evidence of qualification, certification, or registration as required in Contract Documents to verify qualifications of professional land surveyor, engineer, materials testing laboratory, specialty Subcontractor, trade, Specialist, consultant, installer, and other professionals.

M. Submittals Required by Laws, Regulations, and Governing Agencies:

1. Promptly submit promptly notifications, reports, certifications, payrolls, and otherwise as may be required, directly to the applicable federal, state, or local governing agency or their representative.
2. Transmit to Engineer for Owner's records one copy of correspondence and transmittals (to include enclosures and attachments) between Contractor and governing agency.

N. Test, Evaluation, and Inspection Reports:

1. General: Shall contain signature of person responsible for test or report.
2. Factory:
    a. Identification of product and specification section, type of inspection or test with referenced standard or code.
    b. Date of test, Project title and number, and name and signature of authorized person.
    c. Test results.
    d. If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.

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e. Provide interpretation of test results, when requested by Engineer.
f. Other items as identified in individual specification sections.

3. Field:
   a. As a minimum, include the following:
      1) Project title and number.
      2) Date and time.
      3) Record of temperature and weather conditions.
      4) Identification of product and specification section.
      5) Type and location of test, Sample, or inspection, including referenced standard or code.
      6) Date issued, testing laboratory name, address, and telephone number, and name and signature of laboratory inspector.
      7) If test or inspection deems material or equipment not in compliance with Contract Documents, identify corrective action necessary to bring into compliance.
      8) Provide interpretation of test results, when requested by Engineer.
      9) Other items as identified in individual specification sections.

O. Testing and Startup Data: In accordance with Section 01 91 14, Equipment Testing and Facility Startup.

P. Training Data: In accordance with Section 01 43 33, Manufacturers' Field Services.

1.05 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this specification.

1. Transmittal of Contractor's Submittal.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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Jacobs

TRANSMITTAL OF CONTRACTOR'S SUBMITTAL

(ATTACH TO EACH SUBMITTAL)

DATE: _____

TO: _____	Submittal No.: _____
	☐ New Submittal ☐ Resubmittal
	Project: _____
	Project No.: _____
	Specification Section No.: _____ **(Cover only one section with each transmittal)**
FROM: _____ Contractor	Schedule Date of Submittal: _____

SUBMITTAL TYPE:	☐ Shop Drawing	☐ Sample	☐ Informational
	☐ Deferred		

The following items are hereby submitted:

Number of Copies	Description of Item Submitted (Type, Size, Model Number, Etc.)	Spec. and Para. No.	Drawing or Brochure Number	Contains Variation to Contract	
				No	Yes

Contractor hereby certifies that (i) Contractor has complied with the requirements of Contract Documents in preparation, review, and submission of designated Submittal and (ii) the Submittal is complete and in accordance with the Contract Documents and requirements of laws and regulations and governing agencies.

By: _____
Contractor (Authorized Signature)

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SECTION 01 42 13
ABBREVIATIONS AND ACRONYMS

PART 1 GENERAL

1.01 REFERENCE TO STANDARDS AND SPECIFICATIONS OF TECHNICAL SOCIETIES

A. Reference to standards and specifications of technical societies and reporting and resolving discrepancies associated therewith shall be as provided in Article 3 of the General Conditions, and as may otherwise be required herein and in the individual specification sections.

B. Work specified by reference to published standard or specification of government agency, technical association, trade association, professional society or institute, testing agency, or other organization shall meet requirements or surpass minimum standards of quality for materials and workmanship established by designated standard or specification.

C. Where so specified, products or workmanship shall also meet or exceed additional prescriptive or performance requirements included within Contract Documents to establish a higher or more stringent standard of quality than required by referenced standard.

D. Where two or more standards are specified to establish quality, product and workmanship shall meet or exceed requirements of most stringent.

E. Where both a standard and a brand name are specified for a product in Contract Documents, proprietary product named shall meet or exceed requirements of specified reference standard.

F. Copies of standards and specifications of technical societies:

1. Copies of applicable referenced standards have not been bound in these Contract Documents.
2. Where copies of standards are needed by Contractor, obtain a copy or copies directly from publication source and maintain in an orderly manner at the Site as Work Site records, available to Contractor’s personnel, Subcontractors, Owner, and Engineer.

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1.02 ABBREVIATIONS

A. Abbreviations for trade organizations and government agencies: Following is a list of construction industry organizations and government agencies to which references may be made in the Contract Documents, with abbreviations used.

1.	AA	Aluminum Association
2.	AABC	Associated Air Balance Council
3.	AAMA	American Architectural Manufacturers Association
4.	AASHTO	American Association of State Highway and Transportation Officials
5.	ABMA	American Bearing Manufacturers' Association
6.	ACI	American Concrete Institute
7.	AEIC	Association of Edison Illuminating Companies
8.	AGA	American Gas Association
9.	AGMA	American Gear Manufacturers' Association
10.	AI	Asphalt Institute
11.	AISC	American Institute of Steel Construction
12.	AISI	American Iron and Steel Institute
13.	AITC	American Institute of Timber Construction
14.	ALS	American Lumber Standards
15.	AMCA	Air Movement and Control Association
16.	ANSI	American National Standards Institute
17.	APA	APA – The Engineered Wood Association
18.	API	American Petroleum Institute
19.	APWA	American Public Works Association
20.	AHRI	Air-Conditioning, Heating, and Refrigeration Institute
21.	ASA	Acoustical Society of America
22.	ASABE	American Society of Agricultural and Biological Engineers
23.	ASCE	American Society of Civil Engineers
24.	ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
25.	ASME	American Society of Mechanical Engineers
26.	ASNT	American Society for Nondestructive Testing
27.	ASSE	American Society of Sanitary Engineering
28.	ASTM	ASTM International
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPI	American Wood Preservers' Institute
32.	AWS	American Welding Society
33.	AWWA	American Water Works Association

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34.	BHMA	Builders Hardware Manufacturers' Association
35.	CBM	Certified Ballast Manufacturer
36.	CCSD	Clackamas County Sewer District
37.	CDA	Copper Development Association
38.	CGA	Compressed Gas Association
39.	CISPI	Cast Iron Soil Pipe Institute
40.	CMAA	Crane Manufacturers' Association of America
41.	CRSI	Concrete Reinforcing Steel Institute
42.	CS	Commercial Standard
43.	CSA	Canadian Standards Association
44.	CSI	Construction Specifications Institute
45.	DIN	Deutsches Institut für Normung e.V.
46.	DIPRA	Ductile Iron Pipe Research Association
47.	EIA	Electronic Industries Alliance
48.	EJCDC	Engineers Joint Contract Documents' Committee
49.	ETL	Electrical Test Laboratories
50.	FAA	Federal Aviation Administration
51.	FCC	Federal Communications Commission
52.	FDA	Food and Drug Administration
53.	FEMA	Federal Emergency Management Agency
54.	FIPS	Federal Information Processing Standards
55.	FM	FM Global
56.	Fed. Spec.	Federal Specifications (FAA Specifications)
57.	FS	Federal Specifications and Standards (Technical Specifications)
58.	GA	Gypsum Association
59.	GANA	Glass Association of North America
60.	HI	Hydraulic Institute
61.	HMI	Hoist Manufacturers' Institute
62.	IBC	International Building Code
63.	ICBO	International Conference of Building Officials
64.	ICC	International Code Council
65.	ICEA	Insulated Cable Engineers' Association
66.	IFC	International Fire Code
67.	IEEE	Institute of Electrical and Electronics Engineers, Inc.
68.	IESNA	Illuminating Engineering Society of North America
69.	IFI	Industrial Fasteners Institute
70.	IGMA	Insulating Glass Manufacturer's Alliance
71.	IMC	International Mechanical Code
72.	INDA	Association of the Nonwoven Fabrics Industry
73.	IPC	International Plumbing Code

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74.	ISA	International Society of Automation
75.	ISO	International Organization for Standardization
76.	ITL	Independent Testing Laboratory
77.	JIC	Joint Industry Conferences of Hydraulic Manufacturers
78.	MGD	Million gallons per day
79.	MIA	Marble Institute of America
80.	MIL	Military Specifications
81.	MMA	Monorail Manufacturers' Association
82.	MSS	Manufacturer's Standardization Society
83.	NAAMM	National Association of Architectural Metal Manufacturers
84.	NACE	NACE International
85.	NBGQA	National Building Granite Quarries Association
86.	NEBB	National Environmental Balancing Bureau
87.	NEC	National Electrical Code
88.	NECA	National Electrical Contractor's Association
89.	NEMA	National Electrical Manufacturers' Association
90.	NESC	National Electrical Safety Code
91.	NETA	International Electrical Testing Association
92.	NFPA	National Fire Protection Association
93.	NHLA	National Hardwood Lumber Association
94.	NICET	National Institute for Certification in Engineering Technologies
95.	NIST	National Institute of Standards and Technology
96.	NRCA	National Roofing Contractors Association
97.	NRTL	Nationally Recognized Testing Laboratories
98.	NSF	NSF International
99.	NSPE	National Society of Professional Engineers
100.	NTMA	National Terrazzo and Mosaic Association
101.	NWWDA	National Wood Window and Door Association
102.	OSHA	Occupational Safety and Health Act (both Federal and State)
103.	PCI	Precast/Prestressed Concrete Institute
104.	PEI	Porcelain Enamel Institute
105.	PPI	Plastic Pipe Institute
106.	PS	Product Standards Section-U.S. Department of Commerce
107.	PWCM	ProjectWise® Construction Management
108.	RMA	Rubber Manufacturers' Association
109.	RUS	Rural Utilities Service
110.	SAE	SAE International

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111.	SDI	Steel Deck Institute
112.	SDI	Steel Door Institute
113.	SJI	Steel Joist Institute
114.	SMACNA	Sheet Metal and Air Conditioning Contractors National Association
115.	SPI	Society of the Plastics Industry
116.	SSPC	The Society for Protective Coatings
117.	STI/SPFA	Steel Tank Institute/Steel Plate Fabricators Association
118.	SWI	Steel Window Institute
119.	TEMA	Tubular Exchanger Manufacturers' Association
120.	TCA	Tile Council of North America
121.	TCWRRF	Tri-City Water Resource Recovery Facility
122.	TIA	Telecommunications Industry Association
123.	UBC	Uniform Building Code
124.	UFC	Uniform Fire Code
125.	UL	Underwriters Laboratories Inc.
126.	UMC	Uniform Mechanical Code
127.	USBR	U.S. Bureau of Reclamation
128.	WCLIB	West Coast Lumber Inspection Bureau
129.	WES	Water Environment Services
130.	WI	Wood Institute
131.	WRRF	Water Resource Recovery Facility
132.	WWPA	Western Wood Products Association

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02 SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this Specification, not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit, in accordance with requirements of this Specification, proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified in the individual specification section.

B. Representative subject to acceptance by Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, when required by an individual specification section, to meet the requirements of this section.

B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.

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C. Schedule manufacturer' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

D. Determine, before scheduling services, that conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Engineer will be credited to fulfill specified minimum services.

F. When specified in individual specification sections, manufacturer's onsite services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Engineer.
4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during functional and performance testing, and facility startup and evaluation.
7. Training of Owner's personnel in the operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by equipment manufacturer's representative.

B. Such form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.

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3.03 TRAINING

A. General:

1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable specifications.
2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01 78 23, Operation and Maintenance Data.
3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operation and maintenance data, to be retained by each trainee.

B. Training Schedule:

1. List specified equipment and systems that require training services and show:
   a. Respective manufacturer.
   b. Estimated dates for installation completion.
   c. Estimated training dates.
2. Allow for multiple sessions when several shifts are involved.
3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
4. Coordinate with Section 01 32 00, Construction Progress Documentation, and Section 01 91 14, Equipment Testing and Facility Startup.

C. Lesson Plan:

1. When manufacturer or vendor training of Owner personnel is specified, prepare a lesson plan for each required course containing the following minimum information:
   a. Title and objectives.
   b. Recommended attendees (such as, managers, engineers, operators, maintenance).
   c. Course description, outline of course content, and estimated class duration.
   d. Format (such as, lecture, self-study, demonstration, hands-on).

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e. Instruction materials and equipment requirements.
f. Resumes of instructors providing training.

D. Prestartup Training:

1. Coordinate training sessions with Owner's operating personnel and manufacturers' representatives, and with submission of operation and maintenance manuals in accordance with Section 01 78 23, Operation and Maintenance Data.
2. Complete at least 14 days prior to beginning of facility startup.

E. Post-startup Training: If required in Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

F. Recording of Training Sessions: Provided by Owner. Coordinate with Owner's designated video production representative, to facilitate appropriate audio and video recording of prestartup and post-startup instruction sessions, including manufacturers' representatives' hands-on equipment instruction and classroom sessions.

3.04 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this specification.

1. Manufacturer's Certificate of Proper Installation.

END OF SECTION

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MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ Functional tests.

☐ System has been performance tested, and meets or exceeds specified performance requirements (When complete system of one manufacturer).

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate their equipment and (iii) authorized to make recommendations required to ensure equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer:_____

By Manufacturer's Authorized Representative: _____
(Authorized Signature)

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SECTION 01 45 16.13
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D3740, Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   b. E329, Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.02 DEFINITIONS

A. Contractor Quality Control (CQC): The means by which Contractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Contract.

1.03 SUBMITTALS

A. Informational Submittals:

1. CQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
2. CQC Report: Submit, weekly, an original and one copy in report form.

1.04 OWNER'S QUALITY ASSURANCE

A. All Work is subject to Owner's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the Contract Documents.

B. Owner's quality assurance inspections and tests are for the sole benefit of Owner and do not:

1. Relieve Contractor of responsibility for providing adequate quality control measures;
2. Relieve Contractor of responsibility for damage to or loss of the material before acceptance;

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3. Constitute or imply acceptance; or
4. Affect the continuing rights of Owner after acceptance of the completed Work.

C. The presence or absence of a quality assurance inspector does not relieve Contractor from any Contract requirement.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by Engineer.

E. Owner may charge Contractor for any additional cost of inspection or test when Work is not ready at the time specified by Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the Contract Documents.

B. Maintain complete inspection records and make them available at all times to Owner and Engineer.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction and demolition operations, both onsite and offsite, including Work by subcontractors, fabricators, suppliers and purchasing agents, and shall be keyed to the proposed construction sequence.

3.02 COORDINATION MEETING

A. After the Preconstruction Conference, but before start of construction, and prior to acceptance of the CQC Plan, schedule a meeting with Engineer and Owner to discuss the quality control system.

B. Develop a mutual understanding of the system details, including the forms for recording the CQC operations, control activities, testing, administration of the

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system for both onsite and offsite Work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures that may require corrective action by Contractor.

3.03 QUALITY CONTROL ORGANIZATION

A. CQC System Manager:

1. Designate an individual within Contractor's organization who will be responsible for overall management of CQC and have the authority to act in CQC matters for the Contractor.
2. CQC System Manager shall be an experienced construction person, with a minimum of 3 years' construction experience on similar type Work.
3. CQC System Manager shall report to the Contractor's project manager or someone higher in the organization. Project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
4. CQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.
5. Identify an alternate for CQC System Manager to serve with full authority during the System Manager's absence. The requirements for the alternate will be the same as for designated CQC System Manager.

B. CQC Staff:

1. Designate a CQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Contract. CQC staff members shall be subject to acceptance by Engineer.
2. CQC staff shall take direction from CQC System Manager in matters pertaining to QC.
3. CQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
4. The actual strength of the CQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper CQC organization.

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C. Organizational Changes: Obtain Engineer's acceptance before replacing any member of the CQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.

3.04 QUALITY CONTROL PHASING

A. CQC shall include at least three phases of control to be conducted by CQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Owner at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The CQC System Manager shall instruct applicable CQC staff as to the acceptable level of workmanship required in order to meet Contract requirements.
   c. Document the results of the preparatory phase meeting by separate minutes prepared by the CQC System Manager and attached to the QC report.
   d. Perform prior to beginning Work on each definable feature of Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify that all materials and/or equipment have been tested, submitted, and approved.
      4) Verify that provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
      7) Review the appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
      10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by Engineer.

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2. Initial Phase:
   a. Accomplish at the beginning of a definable feature of Work:
      1) Notify Owner at least 48 hours in advance of beginning the initial phase.
      2) Perform prior to beginning Work on each definable feature of Work:
         a) Review minutes of the preparatory meeting.
         b) Check preliminary Work to verify compliance with Contract requirements.
         c) Verify required control inspection and testing.
         d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
         e) Resolve all differences.
         f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
      3) Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
      4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
3. Follow-up Phase:
   a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.
   b. Daily checks shall be made a matter of record in the CQC documentation and shall document specific results of inspections for all features of Work for the day or shift.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.
4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Owner if the quality of ongoing Work is unacceptable; or if there are changes in the applicable QC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

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3.05 CONTRACTOR QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. An interim plan for the first 30 days of operation will be considered.
3. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended CQC organization for the entire Contract and shall include the following, as a minimum:
   a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three-phase control system (see Article Quality Control Phasing) for all aspects of the Work specified.
   b. CQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
   c. Letters of Authority: A copy of a letter to the CQC System Manager signed by an authorized official of the firm, describing the responsibilities, and delegating sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop Work which is not in compliance with the Contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities. Copies of these letters will also be furnished to Owner.
   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.
   e. Testing: Control, verification and acceptance testing procedures for each specific test to include the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required.

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f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.
g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
h. Reporting procedures, including proposed reporting formats; include a copy of the CQC report form.

C. Acceptance of Plans: Acceptance of the Contractor's basic and addendum CQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Owner reserves the right to require Contractor to make changes in the CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC plan, Contractor shall notify Engineer, in writing, a minimum of 7 calendar days prior to any proposed change. Proposed changes are subject to acceptance by Engineer.

3.06 CONTRACTOR QUALITY CONTROL REPORT

A. As a minimum, prepare and submit a CQC report for every 7 calendar days. Account for all days throughout the life of the Contract. Reports shall be signed and dated by CQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Contractor/subcontractor and their areas of responsibility.
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When a network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.

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6. Identify submittals reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts on Drawings and/or Specifications.
10. Contractor's verification statement.
11. Indicate a description of trades working on the Project; the number of personnel working; weather conditions encountered; and any delays encountered.
12. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Contract.

3.07 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01 33 00, Submittal Procedures. The CQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements. Owner will furnish copies of test report forms upon request by Contractor. Contractor may use other forms as approved.

3.08 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to Contract requirements. Procure services of a licensed testing laboratory. Perform the following activities and record the following data:
    a. Verify testing procedures comply with contract requirements.
    b. Verify facilities and testing equipment are available and comply with testing standards.
    c. Check test instrument calibration data against certified standards.
    d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
    e. Documentation:
        1) Record results of all tests taken, both passing and failing, on the CQC report for the date taken.
        2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.

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3) Actual test reports may be submitted later, if approved by Engineer, with a reference to the test number and date taken.
4) Provide directly to Engineer an information copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where the tests are performed.
5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI).

3.09 COMPLETION INSPECTION

A. CQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Contract.

B. Punchlist:

1. CQC System Manager shall develop a punchlist of items which do not conform to the Contract requirements.
2. Include punchlist in the CQC report, indicating the estimated date by which the deficiencies will be corrected.
3. CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Owner.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

END OF SECTION

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SECTION 01 45 33
SPECIAL INSPECTION, OBSERVATION, AND TESTING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for Special Inspection, Observation, and Testing required in accordance with Chapter 17 of the 2018 International Building Code for items identified in the Contractor's Statement of Responsibility.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. International Code Council (ICC):
   a. International Building Code (IBC).
   b. Evaluation Service (ICC-ES) Reports and Legacy Reports.

1.03 DEFINITIONS

A. Agencies and Personnel:

1. Agency Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.
2. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved.
3. Registered Design Professional in Responsible Charge: An individual who is registered or licensed to practice their respective design profession as defined by statutory requirements of professional registration laws of state or jurisdiction in which Project is to be constructed.
4. Special Inspector: Qualified person employed by Owner who will demonstrate competence to the satisfaction of AHJ for inspection of a particular type of construction or operation requiring Special Inspection.

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B. Nonstructural Components:

1. Electrical Component Supports: Structural members or assemblies which transmit loads and forces from electrical equipment to structure, including braces, frames, legs, pedestals, and tethers, as well as elements forged or cast as part of component for anchorage.
2. Mechanical Component Supports: Structural members or assemblies which transmit loads and forces from mechanical equipment to structure, including braces, frames, skirts, legs, saddles, pedestals, snubbers, and tethers, as well as elements forged or cast as part of component for anchorage.

C. Professional Observation:

1. Does not include or waive responsibility for required Special Inspection or inspections by building official.
2. Structural Observation: Visual observation of structural system(s) by a registered design professional for general conformance to Contract Documents.

D. Special Inspection:

1. Special Inspection: Inspection required of materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved Contract Documents and referenced standards.
2. Special Inspection, Continuous: Full-time observation of Work requiring Special Inspection by an approved Special Inspector who is present in area where the Work is being performed.
3. Special Inspection, Periodic: Part-time or intermittent observation of the Work requiring Special Inspection by an approved Special Inspector who is present in area where the Work has been or is being performed, and at completion of the Work.

1.04 SUBMITTALS

A. Informational Submittals:

1. Contractor’s Statement of Responsibility: Form shall be completed by entity responsible for construction of component listed in Contractor’s Statement of Responsibility. Refer to Article Supplements located at end of section.

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1.05 STATEMENT OF SPECIAL INSPECTIONS REQUIREMENTS

A. Statement of Special Inspections:

1. The following identifies elements of inspection, observation, and testing program to be followed in construction of the Work:
   a. Special Inspection and testing required by IBC Section 1705 and other applicable sections and referenced standards therein.
   b. Continuous special inspection of miscellaneous anchorage of structural, mechanical, and electrical items.

B. Special Inspection and associated testing of field construction will be performed by an approved accredited independent agency or by Authority Having Jurisdiction's (AHJ) approved, qualified inspection staff. Owner will secure and pay for services of agency to perform Special Inspection and associated testing.

C. Code required Special Inspection with associated testing and Professional Observation, as in this section, is for benefit of Owner and does not:

1. Relieve Contractor of responsibility for providing adequate quality control measures.
2. Relieve Contractor of responsibility for damage to or loss of material before acceptance.
3. Constitute or imply acceptance.
4. Affect continuing rights of Owner after acceptance of completed Work.

D. The presence or absence of code required Special Inspector and Professional Observer does not relieve Contractor from Contract requirements.

E. Contractor is responsible for additional costs associated with Special Inspection and Testing and Observation when Work is not ready at time identified by Contractor and Special Inspectors and Professional Observer are onsite, but not able to provide contracted services.

F. Contractor is responsible for associated costs for additional Special Inspection and Testing and Professional Observation by Special Inspectors and Professional Observers required because of rejection of materials of in-place Work that cannot be made compliant to Contract Document without additional inspections and observation and testing.

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Requirements of the Special Inspections are provided by the Owner. All other testing and inspections, unless noted otherwise, are provided by Contractor.

B. Notify Engineer in advance of required Special Inspection and Professional Observation no later than 48 hours prior to date of Special Inspection and Professional Observation.

C. Provide access for Special Inspector to construction documents.

D. Retain special inspection records on-site to be readily available for review.

E. Cooperate with Special Inspector and provide safe access to the Work to be inspected.

F. Provide reasonable auxiliary services as requested by the Special Inspector. Auxiliary services required include, but not limited to:

1. Providing access to the Work and furnishing incidental labor and facilities necessary to facilitate inspections and tests to assist the Special Inspector in performing test/inspections.
2. Providing the Special Inspector with access to all approved submittals.

G. Materials and systems shall be inspected during placement where Continuous Special Inspection is required.

3.02 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this specification:

1. Contractor’s Statement of Responsibility.

END OF SECTION

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CONTRACTOR'S STATEMENT OF RESPONSIBILITY

_____
(Project)

_____
(Name of Contracting Company)

_____
(Business Address)

(_____) _____ (_____) _____
(Telephone) (Fax)

I, (We) hereby certify that I am (we are) aware of the Special Inspection and Testing and Professional Observation in Contract Documents for this Project for components including architectural, mechanical, and electrical components and that:

1. I, (We) aware of the systems and the requirements of the special inspection and acknowledge our responsibility in the implementation of the Statement of Special Inspections for the construction of the following systems:

Facility	Specification	Lateral Force-Resisting System
210 – Existing Primary Clarifier	N/A	Miscellaneous structural, mechanical, and electrical anchorage. Inspection shall be continuous during anchorage installation.

3. Control of this Work will be exercised to obtain conformance with Contract Documents approved by building official.

4. Procedures within the Contractor's organization to be used for exercising control of the Work, method and frequency of reporting, and distribution of reports required under Statement of Special Inspections for Project are attached to this statement.

5. I, (We) will provide 48-hour notification to Engineer and approved inspection agency as required for structural tests and Special Inspection for Project.

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6. The following person is hereby identified as exercising control over requirements of this section for the Work designated above:

Name: _____

Qualifications: _____

_____

_____

(Print name and official title of person signing this form)

Signed by: _____

Date: _____

Project Name: _____

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SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of Nurserymen (AAN): American Standards for Nursery Stock.
2. Federal Emergency Management Agency (FEMA).
3. National Fire Prevention Association (NFPA): 241, Standard for Safeguarding Construction, Alteration, and Demolition Operations.
4. Telecommunications Industry Association (TIA); Electronic Industries Alliance (EIA): 568B, Commercial Building Telecommunications Cabling Standard.
5. U.S. Department of Agriculture (USDA): Urban Hydrology for Small Watersheds.
6. U.S. Weather Bureau: Rainfall-Frequency Atlas of the U.S. for Durations from 30 Minutes to 24 Hours and Return Periods from 1 Year to 100 Years.

1.02 SUBMITTALS

A. Informational Submittals:

1. Copies of permits and approvals for construction as required by Laws and Regulations and governing agencies.
2. Temporary Utility Submittals:
   a. Electric power supply and distribution plans.
   b. Water supply and distribution plans.
   c. Sanitary.
3. Temporary Construction Submittals:
   a. Access Roads: Routes, cross-sections, and drainage facilities.
   b. Parking area plans.
   c. Contractor’s field office, storage yard, and storage building plans, including gravel surfaced area.
   d. Fencing and protective barrier locations and details.
   e. Staging area location plan.
   f. Traffic and Pedestrian Control and Routing Plans: As specified herein, and proposed revisions thereto.
   g. Plan for maintenance of existing plant operations.

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4. Temporary Control Submittals:
   a. Dust control plan.
   b. Noise control plan.
   c. Waste management plan.
5. Waste profile sampling results for each non-hazardous solid waste and hazardous waste stream.
6. Written acceptance from permitted waste disposal facilities for each non-hazardous solid waste and hazardous waste stream.

1.03 MOBILIZATION

A. Mobilization includes, but is not limited to, these principal items:

1. Obtaining required permits.
2. Moving Contractor's field office and equipment required for first month operations onto Site.
3. Installing temporary construction power, wiring, and lighting facilities.
4. Providing onsite internet service and telephones.
5. Providing onsite sanitary facilities and potable water facilities as specified and as required by Laws and Regulations, and governing agencies.
6. Arranging for and erection of Contractor's work and storage yard.
7. Posting OSHA required notices and establishing safety programs and procedures.
8. Having Contractor's superintendent at Site full time.

B. Use area designated for Contractor's temporary facilities as shown on Drawings.

C. Upon written request, Owner will provide connection to internet outside of a single Contractor office trailer. No internet network infrastructure will be provided by Owner. Owner will make this connection available to Contractor at no cost. Contractor shall be responsible for providing Contractor's own internet services at no additional cost to Owner should the Owner-provided internet connection be unsatisfactory to Contractor or otherwise fail to meet Contractor's needs.

1.04 PROTECTION OF WORK AND PROPERTY

A. Comply with Owner's safety rules while on Owner's property.

B. Keep Owner informed of serious onsite accidents and related claims.

C. Use of Explosives: No blasting or use of explosives will be allowed onsite.

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1.05 VEHICULAR TRAFFIC

A. Traffic Control Plan:

1. Adhere to traffic control plan reviewed and accepted by Engineer. Changes to this plan shall be made only by written approval of Engineer. Secure approvals for necessary changes so as not to delay progress of the Work.
2. Maintain traffic lanes wide enough or located to include an allowable travel path for semitrailer trucks to access existing Dewatered Cake Loadout (Facility 580). The roadway north of the existing primary clarifiers (Facility 210) shall remain open for one-way traffic in addition to maintaining access and parking for semitrailer trucks to access existing sodium hypochlorite fill station (Facility 420). The roadway south of the existing primary clarifiers (Facility 210) shall remain open for one-way traffic in addition to maintaining access to the existing Membrane Building (Facility 390) and existing Membrane Electrical Building.

B. Traffic Routing Plan: Show sequences of construction affecting use of roadways, time required for each phase of the Work, provisions for decking over excavations and phasing of operations to provide necessary access, and plans for signing, barricading, and striping to provide passages for pedestrians and vehicles.

PART 2 PRODUCTS

2.01 TEMPORARY BYPASS PUMPING SYSTEM

A. Provide temporary bypass pumping system for existing primary clarifiers as show on Drawings and as specified in Section 01 50 10, Bypass Pumping.

2.02 ENGINEER’S FIELD OFFICES

A. Owner will furnish Engineer’s Field Offices.

2.03 PROJECT SIGN

A. Refer to Division 00, Procurement and Contracting Requirements, for requirements for project signage. Provide and maintain one, 8-foot-wide by 4-foot-high sign constructed of 3/4-inch exterior high density overlaid plywood. Sign shall bear name of Project, Owner, Contractor, and Engineer. Lettering shall be black applied on white background by an experienced sign painter. Provide exterior type enamel paint. Information to be included and logo graphic will be provided by Engineer.

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PART 3 EXECUTION

3.01 ENGINEER'S FIELD OFFICE

A. No work by Contractor for Engineers field office.

3.02 BYPASS PUMPING SYSTEM

A. As specified in Section 01 50 10, Bypass Pumping.

3.03 TEMPORARY UTILITIES

A. Power:

1. Electric power will be available at or near Site. Determine type and amount available and make arrangements for obtaining temporary electric power service, metering equipment, and pay costs for electric power used during Contract period, except for portions of the Work designated in writing by Engineer as substantially complete.
2. Cost of electric power will be borne by Contractor.

B. Lighting: Provide temporary lighting to meet applicable safety requirements to allow erection, application, or installation of materials and equipment, and observation or inspection of the Work.

C. Heating, Cooling, and Ventilating:

1. Provide as required to maintain adequate environmental conditions to facilitate progress of the Work, to meet specified minimum conditions for installation of materials, and to protect materials, equipment, and finishes from damage because of temperature or humidity. Costs for temporary heat shall be borne by Contractor responsible for constructing structure or building as specified in Section 01 11 00, Summary of Work.
2. Provide adequate forced air ventilation of enclosed areas to cure installed materials, to dispense humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.
3. Pay costs of installation, maintenance, operation, removal, and fuel consumed.
4. Provide portable unit heaters, complete with controls, oil-fired or gas-fired, and suitably vented to outside as required for protection of health and property.
5. If permanent natural gas piping is used for temporary heating units, do not modify or reroute gas piping without approval of utility company. Provide separate gas metering as required by utility.

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D. Water:

1. Hydrant Water:
   a. Is available from nearby hydrants. Secure written permission for connection and use from water utility and meet requirements for use including any and all fees for use of water. Notify fire department before obtaining water from fire hydrants.
   b. Use only special hydrant-operating wrenches to open hydrants. Make certain hydrant valve is open full, since cracking valve causes damage to hydrant. Repair damaged hydrants and notify appropriate agency as quickly as possible. Hydrants shall be completely accessible to fire department at all times.
2. Include costs to connect and transport water to construction areas in Contract Price.
3. Nonpotable Water: Owner will provide a place of temporary connection for non-potable (W3) water at Site. Provide temporary facilities and piping to bring water to point of use and remove when no longer needed. Availability of W3 water is subject to timing and maximum flow rate restrictions to be coordinated with the Owner.

E. Sanitary and Personnel Facilities:

1. Provide and maintain facilities for Contractor's employees, Subcontractors, and other onsite employers' employees. Service, clean, and maintain facilities and enclosures.
2. Obtain Owner's permission before allowing construction personnel to use existing sanitary facilities at Site. Use of Owner's existing sanitary facilities by construction personnel will not be allowed.
3. Sanitary Sewer Connection: Owner will provide a place of temporary connection for sanitary sewer at Site. Provide temporary facilities and piping to bring sanitary sewer from Contractor's field office to point of use and remove when no longer needed.

F. Telephone Service:

1. Contractor: Arrange and provide onsite telephone service for Contractor's use during construction. Pay costs of installation and monthly bills.
2. Engineer: Provided by Owner. No Contractor work required.
3. No incoming calls allowed to Owner's plant telephone system.

G. Fire Protection: Furnish and maintain on Site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable parts of NFPA 241.

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3.04 PROTECTION OF WORK AND PROPERTY

A. General:

1. Perform Work within right-of-way and easements in a systematic manner that minimizes inconvenience to property owners and the public.
2. No access shall be cut off from vehicular traffic for a period exceeding 1 hour unless special arrangements have been made.
3. Where completion of the Work requires temporary or permanent removal or relocation of existing utility, coordinate activities with owner of said utility and perform Work to their satisfaction.
4. Protect, shore, brace, support, and maintain underground pipes, conduits, drains, and other underground utility construction uncovered or otherwise affected by construction operations.
5. Keep fire hydrants and water control valves free from obstruction and available for use at all times.
6. In areas where Contractor's operations are adjacent to or near a utility, such as gas, telephone, television, electric power, water, sewer, or irrigation system, and such operations may cause damage or inconvenience, suspend operations until arrangements necessary for protection have been made by Contractor.
7. Notify property owners and utility offices that may be affected by construction operation at least 2 days in advance: Before exposing a utility, obtain utility owner's permission. Should service of utility be interrupted due to Contractor's operation, notify proper authority immediately. Cooperate with said authority in restoring service as promptly as possible and bear costs incurred.
8. Do not impair operation of existing sewer system. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other sewer structures.
9. Maintain original Site drainage wherever possible.

B. Site Security:

1. Erect a temporary security fence as specified in Section 32 31 13, Chain Link Fences and Gates. Maintain fence throughout construction period. Obtain Engineer's written permission before removal of temporary security fencing.
2. Provide and maintain additional temporary security fences as necessary to protect the Work and Contractor-furnished products not yet installed.

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C. Trees and Plantings:

1. Protect from damage and preserve trees, shrubs, and other plants outside limits of the Work and within limits of the Work, which are designated on Drawings to remain undisturbed.
    a. Where practical, tunnel beneath trees when on or near line of trench.
    b. Employ hand excavation as necessary to prevent tree injury.
    c. Do not stockpile materials or permit traffic within drip lines of trees.
    d. Provide and maintain temporary barricades around trees.
    e. Water vegetation as necessary to maintain health.
    f. Cover temporarily exposed roots with wet burlap, and keep burlap moist until soil is replaced around roots.
    g. No trees, except those specifically shown on Drawings to be removed, shall be removed without written approval of Engineer.
    h. Dispose of removed trees in a legal manner off the Site.
2. Balling and burlapping of trees indicated for replacement shall conform to recommended specifications set forth in the American Standards for Nursery Stock, published by American Association of Nurserymen. Balls shall be firm and intact and made-balls will not be accepted. Handle ball and burlap trees by ball and not by top.
3. In event of damage to bark, trunks, limbs, or roots of plants that are not designated for removal, treat damage by corrective pruning, bark tracing, application of a heavy coating of tree paint, and other accepted horticultural and tree surgery practices.
4. Replace each plant that dies as a result of construction activities.

D. Existing Structures:

1. Where Contractor contemplates removal of small structures such as mailboxes, signposts, and culverts that interfere with Contractor's operations, obtain approval of property owner and Engineer.
2. Move mailboxes to temporary locations accessible to postal service.
3. Replace items removed in their original location and a condition equal to or better than original.

E. Finished Construction: Protect finished floors and concrete floors exposed as well as those covered with composition tile or other applied surfacing.

F. Waterways: Keep ditches, culverts, and natural drainages continuously free of construction materials and debris.

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G. Dewatering: Construct, maintain, and operate cofferdams, channels, flume drains, sumps, pumps, or other temporary diversion and protection works. Furnish materials required, install, maintain, and operate necessary pumping and other equipment for the environmentally safe removal and disposal of water from the various parts of the Work. Maintain foundations and parts of the Work free from water.

H. Archaeological Finds:

1. General: Should finds of an archaeological or paleontological nature be made within Site limits, immediately notify Owner and Engineer and proceed in accordance with General Conditions. Continue the Work in other areas without interruption.
2. Archaeological Finds: Evidence of human occupation or use of an area within contract limits prior to the Year 1840. Evidence may consist of skeletons, stone, or other utensils, or evidence of habitations or structures.
3. Paleontological Finds: Evidence of prehistoric plant or animal life, such as skeletons, bones, fossils, or casts and other indications such as pictographs.
4. Owner may order the Work stopped in other areas if, in Owner's opinion, find is more extensive than may appear from uncovered material.
5. Protection of Finds:
    a. Cover, fence, or otherwise protect finds until notice to resume the Work is given.
    b. Cover finds with plastic film held in place by earth, rocks, or other weights placed outside the find. Should additional backfilling be necessary for safety or to prevent caving, place backfill material loosely over plastic film.
    c. Sheet or shore as necessary to protect excavations underway. Place temporary fence to prevent unauthorized access.
    d. Dewater finds made below water table as necessary to protect construction Work underway. Divert groundwater or surface runoff away from find by ditching or other acceptable means.
6. Removal of Finds:
    a. Finds are property of Owner. Do not remove or disturb finds without Owner's written authorization.
    b. Should Owner elect to have a find removed, provide equipment, labor, and material to permit safe removal of find without damage. Provide transportation for delivery to individuals, institutions, or other places as Owner may find desirable, expedient, or required by law.

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I. Endangered and Threatened Species:

1. Take precautions necessary and prudent to protect native endangered and threatened flora and fauna.
2. Notify Engineer of construction activities that might threaten endangered and threatened species or their habitats.
3. Engineer will mark areas known as habitats of endangered and threatened species prior to commencement of onsite activities.
4. Additional areas will be marked by Engineer as other habitats of endangered and threatened species become known during construction.

3.05 TEMPORARY CONTROLS

A. Air Pollution Control:

1. Minimize air pollution from construction operations.
2. Burning of waste materials, rubbish, or other debris will not be permitted on or adjacent to Site.
3. Conduct operations of dumping rock and of carrying rock away in trucks to cause a minimum of dust. Give unpaved streets, roads, detours, or haul roads used in construction area a dust-preventive treatment or periodically water to prevent dust. Strictly adhere to applicable environmental regulations for dust prevention.
4. Provide and maintain temporary dust-tight partitions, bulkheads, or other protective devices during construction to permit normal operation of existing facilities. Construct partitions of plywood, insulating board, plastic sheets, or similar material. Construct partitions in such a manner that dust and dirt from demolition and cutting will not enter other parts of existing building or facilities. Remove temporary partitions as soon as need no longer exists.

B. Noise Control:

1. Provide acoustical barriers so noise emanating from tools or equipment will not exceed legal noise levels.
2. Noise Control Ordinance: As described in the Oregon City Municipal Code.
3. Noise Control Plan: Propose plan to mitigate construction noise and to comply with noise control ordinances, including method of construction, equipment to be used, and acoustical treatments.

C. Water Pollution Control:

1. Divert sanitary sewage and nonstorm waste flow interfering with construction and requiring diversion to sanitary sewers. Do not cause or

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permit action to occur which would cause an overflow to existing waterway.

2. Prior to commencing excavation and construction, obtain Engineer's agreement with detailed plans showing procedures intended to handle and dispose of sewage, groundwater, and dewatering pump discharges.
3. Comply with Section 01 57 13, Temporary Erosion and Sediment Control, for stormwater flow and surface runoff.
4. Do not dispose of volatile wastes such as mineral spirits, oil, chemicals, or paint thinner in storm or sanitary drains. Disposal of wastes into streams or waterways is prohibited. Provide acceptable containers for collection and disposal of waste materials, debris, and rubbish.
5. Concrete Repair and Surface Preparation Waste Stream Disposal: Waste from concrete surface preparation shall be disposed of at a permitted disposal facility in accordance with local, state, and federal regulations.

D. Erosion, Sediment, and Flood Control: Provide, maintain, and operate temporary facilities as specified in Section 01 57 13, Temporary Erosion and Sediment Control, to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period. Note that certain portions of the site including portions of Contractor staging areas are located within the 100-year floodplain.

E. Waste Management and Disposal:

1. Handle, store, package, label, transport, and dispose all waste streams in accordance with federal, state, and local regulations for waste transport and disposal at facilities permitted for the type of waste disposed.
2. Segregate recyclable materials from waste streams (e.g. metal, cardboard, paper, plastic) to minimize waste disposal volume.
3. Waste Management Plan:
    a. Prior to commencing construction, obtain Engineer's agreement with detailed plans showing procedures intended to package, handle, label, transport and dispose of solid and liquid waste streams generated during construction. The waste management plan shall include:
        1) Proposed on-site waste storage and management areas including inspection and labeling of stored wastes.
        2) Intended haul routes and vehicle type.
        3) Waste transporter names, contact information, licenses, and EPA ID numbers.
        4) Procedures for packaging and transporting wastes including lining and tarping procedures to prevent leakage or spread of contamination during transport.

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5) Proposed permitted disposal facilities for each waste stream.
6) Procedures for waste stream characterization samples and proposed analytical laboratories.

4. Collect waste stream characterization samples for non-hazardous solid waste and hazardous waste streams to establish a waste profile with a permitted disposal facility. Sampling frequency shall be as required to meet disposal facility acceptance criteria for each type of waste. Waste samples for potentially hazardous and hazardous waste streams shall include Toxicity Characteristic leaching Procedure sampling if required by the disposal facility. Submit waste profile sampling for each non-hazardous solid waste and hazardous waste stream.
5. Submit written acceptance from permitted waste disposal facility for each non-hazardous solid waste and hazardous waste stream.
6. Hazardous waste generated shall be transported to an approved hazardous waste treatment, storage and disposal facility within 90 days of the accumulation start date on each container.

3.06 STORAGE YARDS AND BUILDINGS

A. Coordinate requirements with Section 01 61 00, Common Product Requirements.

B. Temporary Storage Yards: Construct temporary storage yards for storage of products that are not subject to damage by weather conditions.

C. Temporary Storage Buildings:

1. Provide environmental control systems that meet recommendations of manufacturers of equipment and materials stored.
2. Arrange or partition to provide security of contents and ready access for inspection and inventory.
3. Store combustible materials (paints, solvents, fuels) in a well-ventilated and remote building meeting safety standards.

3.07 ACCESS ROADS

A. Construct access roads as shown and within easements, rights-of-way, or Project limits. Use existing roads where shown. Alignments for new routes shall be approved by Engineer.

B. Maintain drainage ways. Install and maintain culverts to allow water to flow beneath access roads. Provide corrosion-resistant culvert pipe of adequate strength to resist construction loads.

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C. Provide gravel, crushed rock, or other stabilization material to permit access by all motor vehicles at all times.

D. Maintain road grade and crown to eliminate potholes, rutting, and other irregularities that restrict access.

E. Coordinate with Engineer detours and other operations affecting traffic and access. Provide at least 72 hours' notice to Engineer of operations that will alter access to Site.

F. Where access road crosses existing fences, install and maintain gates. Gates and gate posts shall conform to those as specified in Section 32 31 13, Chain Link Fences and Gates.

G. Upon completion of construction, restore ground surface disturbed by access road construction to original grade. Replace damaged or broken culverts with new culvert pipe of same diameter and material.

3.08 PARKING AREAS

A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.

B. Provide parking facilities for personnel working on Project. No employee or equipment parking will be permitted on Owner's existing paved areas.

C. Use area designated on Drawings for parking of Contractor's and Contractor's employees' vehicles. Contractor parking outside of designated areas shall not be permitted.

3.09 VEHICULAR TRAFFIC

A. Comply with Laws and Regulations regarding closing or restricting use of public streets or highways. No public or private road shall be closed, except by written permission of proper authority. Ensure the least possible obstruction to traffic and normal commercial pursuits.

B. Conduct the Work to interfere as little as possible with public travel, whether vehicular or pedestrian.

C. Whenever it is necessary to cross, close, or obstruct roads, driveways, and walks, whether public or private, provide and maintain suitable and safe bridges, detours, or other temporary expedients for accommodation of public and private travel.

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D. Road Closures: Maintain satisfactory means of exit for persons residing or having occasion to transact business along route of the Work. If it is necessary to close off roadway or alley providing sole vehicular access to property for periods greater than 2 hours, provide written notice to each owner so affected 3 days prior to such closure. In such cases, closings of up to 4 hours may be allowed. Closures of up to 10 hours may be allowed if a week's written notice is given and undue hardship does not result.

E. Maintenance of traffic is not required if Contractor obtains written permission from Owner and tenant of private property, or from authority having jurisdiction over public property involved, to obstruct traffic at designated point.

F. In making street crossings, do not block more than one-half the street at a time. Whenever possible, widen shoulder on opposite side to facilitate traffic flow. Provide temporary surfacing on shoulders as necessary.

G. Maintain top of backfilled trenches before they are paved, to allow normal vehicular traffic to pass over. Provide temporary access driveways where required. Cleanup operations shall follow immediately behind backfilling.

H. When flaggers and guards are required by regulation or when deemed necessary for safety, furnish them with approved orange wearing apparel and other regulation traffic control devices.

I. Provide snow removal to facilitate normal vehicular traffic on Site roads affected by construction. Perform snow removal promptly and efficiently by means of suitable equipment whenever necessary for safety, and as may be directed by proper authority.

J. Notify fire department and police department before closing street or portion thereof. Notify said departments when streets are again passable for emergency vehicles. Do not block off emergency vehicle access to consecutive arterial crossings or dead-end streets, in excess of 300 linear feet, without written permission from fire department. Conduct operations with the least interference to fire equipment access, and at no time prevent such access. Furnish Contractor's night emergency telephone numbers to police department.

K. Coordinate traffic routing with that of others working in same or adjacent areas.

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3.10 CLEANING DURING CONSTRUCTION

A. In accordance with General Conditions, as may be specified in other specification sections, and as required herein.

B. Wet down exterior surfaces prior to sweeping to prevent blowing of dust and debris. At least weekly, sweep floors (basins, tunnels, platforms, walkways, roof surfaces), and pick up and dispose of debris.

C. Provide approved containers for collection and disposal of waste materials, debris, and rubbish. At least weekly, dispose of such waste materials, debris, and rubbish offsite.

D. At least weekly, brush sweep entry drive, roadways, and other streets and walkways affected by the Work and where adjacent to the Work.

END OF SECTION

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SECTION 01 50 10
BYPASS PUMPING

PART 1 GENERAL

1.01 GENERAL

A. Conditions that require bypass facilities include, but are not limited to:

1. Normal construction sequencing activities required to complete Project.
2. Inclement weather during temporary shutdowns that require increased treatment or containment capacity.

B. Provide bypass pumping system including, but not limited to, equipment, piping, appurtenances, and controls, required to intercept, convey, and discharge flow to be controlled. Include standby and emergency equipment. Bypass pumping system shall:

1. Protect water resources, wetlands, and other natural resources.
2. Conform to regulatory requirements.
3. Temporary flow control shall be done in a manner that will not damage private or public property, or create a nuisance or public menace.
4. Flow shall be conveyed in enclosed pipes that are adequately protected from traffic or other hazards.

C. Type and locations of bypass and temporary facilities may include, but are not limited to:

1. Pumping from the grit basin chambers to the isolated sections of the primary influent channel when repairing concrete in the primary influent channel. Flow shall be determined by level in the grit chamber basin and shall be split equally between online primary clarifiers using flow meters to verify flow.

D. Bypassing of untreated or partially treated sewage to surface waters or drainage courses is strictly prohibited during construction. In the event accidental bypassing is caused by the Contractor’s operations, the Owner shall immediately be entitled to employ others to stop the bypassing and costs incurred there from, including any regulatory agency fines resulting there from, will be deducted from the Contractor’s construction progress payments. If accidental bypass occurs, the Contractor shall immediately inform the Construction Manager.

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1.02 DEFINITIONS

A. Bypass Pumping: Temporary flow control method to ensure continuous flow of wastewater around any wastewater treatment component, using one or more pumps.

1.03 PERFORMANCE REQUIREMENTS

A. Flows are pumped from the Grit Chambers (Facility 140) into the Primary Sedimentation Influent Channel (Facility 210). It is essential to the operation of the pump stations as well as the Tri-City Water Resource Recovery Facility (WRRF) that there be no restriction of flow for the duration of the Project.

B. N+1 redundancy must be maintained for equipment (pumping system meets firm capacity with largest unit out of service).

1.04 SUBMITTALS

A. Action Submittals:

1. Flow Control Plan:
   a. Estimated Schedule of Work.
   b. Drawings locating bypass pumps, fuel storage, and pipelines; temporary plugs or bulkheads shall be indicated where required for bypass pumping.
   c. Locations where flow will be intercepted and discharged.
   d. Control Scheme for Bypass Pumping:
      1) Control wiring diagrams.
      2) Control narratives and setpoints.
   e. Equipment List:
      1) Bypass pump size and capacities, number of each pump size, and power requirements including standby equipment.
      2) Bypass pumping piping size and materials.
      3) Fuel storage size, capacity, and containment.
   f. Operation plan for 24-hour, 7 days per week, including holidays, as required to maintain treatment through the plant.
   g. Other information to completely describe temporary flow control facilities and conformance to specified requirements.
   h. Detailed emergency procedures and response time for equipment failure.
   i. Plan shall be designed and sealed by a Professional Engineer licensed in the State of Oregon.

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2. Emergency Cleanup Plan:
   a. Procedures for removal of water.
   b. Procedures for determining nature and extent of damage.
   c. Implement for bypass pumping.

1.05 SEQUENCING AND SCHEDULING

A. Protection of the Environment: Conform to the applicable requirements of Section 01 50 00, Temporary Facilities and Controls.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. The bypass pumping system supplier shall have at least 5 years' experience in the design, application, and supply of bypass pumping systems for municipal sewage treatment works.

B. The system shall be provided with a minimum two duty diesel driven pumps and one standby diesel driven pump.

C. The bypass pumping system shall be from one of the following listed below:

1. Rain for Rent.
2. "Or-equal" manufacturers will be considered as specified in Instructions to Bidders and the General Conditions. "Or-equal" manufacturers for equipment of this section shall meet the minimum experience qualifications specified in this section. "Or-equal" manufactures that fail to demonstrate the minimum experience qualifications will not be considered equal.

2.02 GENERAL

A. Provide, install, maintain, and operate temporary bypass facilities, including pumps and temporary components such as dams, plugs, and bulkheads required to keep Owner's Water Resource Recovery Facility operations online.

B. Materials and equipment may be new or used at Contractor's option.

2.03 BYPASS PUMPING

A. Bypass Pumps:

1. Fully automatic, self-priming units that do not require foot valves or vacuum pumps in priming system.

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2. Solids handling design with ability to pump minimum 3-inch diameter sphere.
3. Able to run dry or recirculate flow for long periods of time to accommodate cyclical nature of flows.
4. Diesel Engine: Whisper quiet pump enclosures equipped to minimize noise. Noise levels shall not exceed limits set by Local Ordinances. Provide sound attenuating enclosures as required to meet noise limits.
5. Standby Pump: One of each size onsite shall be available.
6. Bypass pumping performance requirements flow ranges are as follows:
   a. Primary Influent Flow: 0.5 MGD to 22 MGD.

B. Provide adequate equipment capacity and size to handle the range of flows at the treatment plant.

C. Bypass pumps shall be able to maintain level in the aerated grit chambers between Elevation 52.00 and Elevation 49.00.

D. Coordinate suction pipe elevation with Owner to minimize grit pumped but maintain minimum required suction pipe submergence.

E. Bypass pumping facilities shall utilize variable flow pumping to prevent rapid changes in flow; flows shall not increase or decrease by more than 10 percent of flow.

F. Pumped flow shall be measured via a flowmeter.

2.04 PIPING

A. Temporary piping shall be Schedule 80 PVC per Section 40 27 00.10, Polyvinyl Chloride (PVC) Pipe and Fittings Data Sheet, or SDR 32.5, HDPE per Section 22 10 01.08, High Density Polyethylene (HDPE) Pipe and Fittings Data Sheet.

2.05 BULKHEADS

A. Temporary Bulkheads: Provide with ability to remove quickly and without damaging the basin. Provide with eyebolts for quick removal.

B. Lifting mechanism designed to quickly remove bulkhead.

C. Designed for the hydraulic loading.

D. Suggested locations shown on Drawings.

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2.06 SOUND ATTENUATING ENCLOSURES

A. Materials designed for sound attenuation.

B. Designed to provide ventilation require for diesel drive engine pumps.

2.07 PIPE PLUGS

A. Pneumatic Plug: Provide with taps for connection of pressure gauges and air hoses, and flow-through capability.

B. Pipe Diameters 24 Inches and Smaller: Use mechanical plugs with rubber gaskets or pneumatic plugs with rubber boots.

C. Pipe Diameters Larger than 24 Inches:

1. Use inflatable bag stoppers made in two or more pieces or pneumatic plugs.
2. Manufacturers:
   a. Lansas.
   b. Cherne Industries.

PART 3 EXECUTION

3.01 GENERAL

A. Notify Owner at least 7 days prior to implementing bypass pumping.

B. Install temporary systems and maintain flow around Work area in a manner that will not cause property damage, restrict site access, or prevent access to equipment and unaffected Work areas.

C. Operate and maintain temporary systems 24 hours per day, 7 days per week, including without limitation, holidays, as required to control and treat flows.

D. Promptly remove from site all bypass pumping equipment and materials as soon as they are no longer needed.

3.02 EQUIPMENT AND MATERIALS

A. Install and/or locate temporary equipment, appurtenances, and piping required for bypass pumping to maintain treatment through the Tri-City WRRF.

B. Provide all fuel to run and operate bypass pumping.

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3.03 FIELD QUALITY CONTROL

A. Notify Owner 24 hours prior to testing.

B. Hydrostatic Pressure Test for Pump Bypass System: Prior to initiating bypass pump(s), test piping with maximum pressure equal to 1.5 times maximum operating pressure of system.

C. Bypass Pump: Prior to interrupting flow through the plant, operate bypass pumping system for 48 hours and verify pump and controls operate as specified.

END OF SECTION

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SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This section covers Work to implement structural and nonstructural Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off Project Sites. Requirements described in this Specification and shown on Drawings are part of the project Temporary Erosion and Sediment Control Plan (TESC Plan) and are the minimum for all Project construction sites and conditions. This Specification covers all Project activities, including material sources, disposal sites, and offsite mitigation areas unless specific Project activities are excluded elsewhere in this Specification or in other Contract Documents controlling the Work.

B. National Pollutant Discharge Elimination System: Comply with federal, state, and local laws, rules and regulations, and the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Discharge Permit or Permits applicable to the Project. A copy of the Project's General Construction Permit, if applicable to the Project, is available from Owner. NPDES General Construction permits are required on projects that involve disturbance of 1 acre or more with potential to discharge stormwater to surface waters.

C. Other Regulations: A local government erosion and sediment control permit may apply and some local agency requirements may be more stringent than this Specification. Adequate erosion and sediment control is essential for complying with the federal Endangered Species Act where construction runoff enters waters inhabited by protected species.

1.02 REFERENCES

A. Activities shall conform to the Clackamas County Erosion Prevention and Sediment Control Planning Manual as modified by Oregon City Addendum and Drawings. In the event of a conflict, the more stringent requirement shall apply.

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B. The following is a list of standards that may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): M252, Standard Specification for Corrugated Polyethylene Drainage Pipe.
2. ASTM International (ASTM):
   a. D638, Standard Test Method for Tensile Properties of Plastics.
   b. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
   c. D3776/D3776M, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
   d. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
   e. D4397, Standard Specification for Polyethylene Sheeting for Construction, Industrial, and Agricultural Applications.
   f. D4491, Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
   g. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   h. D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
   i. D4751, Standard Test Method for Determining Apparent Opening Size of a Geotextile.
   j. D6241, Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
   k. D6459, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Hillslopes from Rainfall-Induced Erosion.
   l. D6460, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Performance in Protecting Earthen Channels from Stormwater-Induced Erosion.
   m. D6475, Standard Test Method for Measuring Mass Per Unit Area of Erosion Control Blankets.
   n. D7322, Standard Test Method for Determination of Rolled Erosion Control Product (RECP) Ability to Encourage Seed Germination and Plant Growth Under Bench-Scale Conditions.
   o. D7367, Standard Test Method for Determining Water Holding Capacity of Fiber Mulches for Hydraulic Planting.
3. National Weather Service:
   a. Precipitation-Frequency of the United States by State/Territory, 2012.
   b. Precipitation Frequency Data Server, 2012.

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4. North American Weed Management Association (NAWMA).
5. U.S. Department of Agriculture, Natural Resources Conservation Service: *Urban Hydrology for Small Watersheds*; 1986. Technical Release 55.
6. U.S. Environmental Protection Agency:
   a. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, 2007. EPA-833-R-06-004.
   b. National Menu of BMPs, 2012.
7. The sections of the standards referenced above which apply to this Project include, but are not limited to:

Standard	Specification or Detail No.	Symbol	Title
4.2.1	4.4, 4-5		Check Dam
4.1.5	4-1, 4-1		Erosion Control Matting
4.3.4	4-14		Berm
4.3.5	4-20		Inlet Protection
4.1.4	N/A		Mulch
4.1.6	4-3		Plastic Covering
4.3.10	4-23		Silt (Sediment) Fence
4.2.2	4-13		Stabilized Construction Entrance
4.1.4	N/A		Tackifiers
4.2.13	4-26		Tire Wash
4.3.14	4-27		Wattles

1.03 SYSTEM DESCRIPTION

A. Erosion and Sediment Control:

1. Provide, maintain, and operate temporary facilities to control erosion and sediment releases during construction period.
2. Design erosion and sediment controls to handle peak runoff resulting from 25-year, 24-hour storm event based on National Weather Service: Precipitation Frequency Data Server.
3. Size temporary stormwater conveyances based on procedures presented in U.S. Department of Agriculture, Natural Resources Conservation Service: Urban Hydrology for Small Watersheds, 1986. Technical Release 55.

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B. Erosion and Sediment Control (ESC) Lead:

1. Contractor shall designate and provide and ESC lead for the project.
2. Identify the ESC Lead at the preconstruction discussions and in the TESC Plan. The ESC Lead shall have certification in construction site erosion and sediment control from a course approved by Owner.
3. The ESC Lead shall implement the TESC Plan including, but not limited to:
    a. Installing and maintaining all temporary erosion and sediment control Best Management Practices (BMPs) included in the TESC Plan to assure continued performance of their intended function. Damaged or inadequate TESC BMPs shall be corrected immediately.
    b. Updating TESC Plan to reflect current field conditions.
    c. Terminating TESC Plan.
4. When a TESC Plan is included in the Contract Plans, ESC Lead shall also inspect all areas disturbed by construction activities, all onsite erosion and sediment control BMPs, all stormwater discharge points, and all temporarily stabilized inactive sites per schedule in the Construction Stormwater Discharge Permit(s) or as directed by Engineer. Complete erosion and sediment control inspection form provided by water resource agency or Owner for each inspection and submit a copy to Engineer no later than end of the next working day following inspection.

C. Personnel Training:

1. Prior to commencement of construction, applicable personnel must have an understanding of the Construction Stormwater Discharge Permit’s requirements and their specific responsibilities under the permit. At a minimum, personnel must be trained to understand the following as it relates to the scope of their job duties:
    a. The location of all stormwater controls and how to maintain them.
    b. Procedures for complying with the pollution prevention requirements.
    c. Procedures for conducting inspections, recording findings, and taking corrective action.

D. Temporary Erosion and Sediment Control Plan (Stormwater Pollution Prevention Plan):

1. A TESC Plan is furnished as part of Drawings, which helps fulfill part of the plan requirement of the NPDES Permit. This initial TESC Plan, when adopted by Contractor, may be used as the basis of the

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construction TESC Plan. Additional or revised erosion and sediment control features, not shown on the initial TESC Plan, may be required depending on Contractor's methods of operation and schedule.

2. For each phase of the scheduled work, indicate on the TESC Plan all the BMPs proposed and installed for erosion and sediment control to minimize clearing, stabilize exposed soil, divert, or temporarily store flows, limit runoff from exposed areas, and filter transported sediment. Include all temporary slopes, constructed for staging or other reasons, which may not have been identified in the original Contract plans. Refer to the current local jurisdiction's erosion and sediment control manual.
3. Some TESC Plan required elements typically required by NPDES permits:
    a. Narrative Site Description:
        1) Nature of construction activity planned for the Site.
        2) Estimates of total Site area and the areas of the Site expected to be disturbed.
        3) Soil types found onsite and their erosion potential.
        4) The types of fill materials to be used.
        5) Timetable for sequence of major construction events.
    b. Site Map:
        1) All areas of development.
        2) Drainage patterns.
        3) Areas of soil disturbance, including pre-development and post-development elevation contours.
        4) Areas used for storage of soils or wastes.
        5) Areas where vegetative practices are to be implemented.
        6) Location of all erosion and sediment control BMP or structures.
        7) Location of all impervious structures and surfaces after Project is completed.
        8) Springs, wetlands, and other surface waters located onsite.
        9) Boundaries of the 100-year floodplain, if determined.
        10) Ordinary High Water line, if determined.
        11) Location of storm drainage outfalls to receiving waters, if applicable.
        12) Details of sediment and erosion controls.
        13) Details of detention ponds, storm drain piping, inflow, and outflow details.
    c. Required BMPs and Procedures for Erosion Prevention, Runoff Control, and Sediment Control:
        1) Construction entrances and parking areas.
        2) Unpaved Site roads such as haul roads.
        3) Hauling saturated soils from the Site.
        4) Water washed from concrete trucks.

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5) Correct installation of erosion and sediment control BMPs.
6) Prompt maintenance and repair of BMPs.
7) Clearing and grading practices to minimize area of exposed soil throughout life of the Project.
8) Schedule of phased clearing operations to limit soils to what can be stabilized.
9) Vegetative practices, including preservation of existing vegetation, seeding, mulching, and buffer strips.
10) Preventing erosion of exposed areas.
11) Diverting flows from exposed slopes.
12) Limiting runoff from exposed areas.
13) Limiting sediment transport within work sites and keeping it from moving off of Project areas.
14) Perimeter controls for all clearing and grubbing, both planned and installed.
15) Additional controls for wet season work and temporary work suspensions.
16) Sensitive areas, such as wetlands.
17) Offsite material source and waste areas.
18) Dust.
19) Emergency materials stockpiled onsite.
20) Storing flows and filtering sediment.
21) Soil stockpiles.

4. Contractor's construction TESC Plan and implementation schedules must be prepared by a competent individual. Furnish a signed copy of the TESC Plan with individual's name, title, state certifications, and employing firm if different than Contractor's firm.
5. Do not begin any Site activities that have potential to cause erosion or sediment movement until the TESC Plan and implementation schedules are approved by Engineer.
6. Keep a copy of the approved TESC Plan with updated changes onsite during all construction activities. During inactive periods longer than 7 calendar days, keep the TESC Plan onsite or provide a copy to Engineer to retain.
7. Continually update the TESC Plan and schedules as needed for unexpected storm or other events to ensure that sediment-laden water does not leave the construction site. Add approved changes to the TESC Plan no later than 24 hours after implementation.

E. Install clearing limit fence along the Site where shown on Drawings or as instructed by Engineer. Space posts and attach fence fabric to posts as shown on Drawings. Do not fasten fence to trees. Throughout the life of the Project, preserve and protect delineated area, acting immediately to repair or restore any fencing damaged or removed.

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F. Preventing erosion, and controlling runoff, sedimentation, and non-stormwater pollution, requires Contractor to perform temporary Work items including, but not limited to:

1. Providing ditches, berms, culverts, and other measures to control surface water.
2. Building dams, settling basins, energy dissipaters, and other measures, to control downstream flows.
3. Controlling underground water found during construction.
4. Covering or otherwise protecting slopes until permanent erosion control measures are working.

G. To the degree possible, coordinate this temporary Work with permanent drainage and erosion control work the Contract requires.

H. Engineer may require additional temporary control measures if it appears pollution or erosion may result from weather, nature of materials, or progress on the Work.

I. When natural elements rut or erode the slope, restore, and repair damage with eroded material where possible, and remove and dispose of any remaining material found in ditches and culverts. When Engineer orders replacement with additional or other materials, unit Contract prices will cover quantities needed.

J. Install all sediment control devices including, but not limited to, sediment ponds, perimeter silt fencing, or other sediment trapping BMPs prior to any ground disturbing activity. Do not expose more erodible earth than necessary during clearing, grubbing, excavation, borrow, or fill activities without written approval by Engineer. Engineer may increase or decrease the limits based on Project conditions. Erodible earth is defined as any surface where soils, grindings, or other materials may be capable of being displaced and transported by rain, wind, or surface water runoff. Cover inactive areas of erodible earth, whether at final grade or not, within time period as specified in the Erosion and Sediment Control Permit, using an approved soil covering practice. Phase clearing and grading to maximum extent practical to prevent exposed inactive areas from becoming a source of erosion.

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K. Water Management:

1. Manage Site water in accordance with the conditions of the waste discharge permit from the local permitting authority. If Site water management is not subject to permit, manage as follows:
   a. Groundwater:
      1) When groundwater is encountered in an excavation, treat and discharge as follows:
         a) When groundwater conforms to Water Environment Services of Clackamas County Water Quality Standards, it may bypass detention and treatment facilities and be routed directly to its normal discharge point at a rate and method that will not cause erosion.
         b) When turbidity of groundwater is similar to turbidity of Site runoff, groundwater may be treated using same detention and treatment facilities being used to treat the Site runoff and then discharged at a rate that will not cause erosion.
         c) When groundwater turbidity is greater than turbidity of Site runoff, treat ground water separately until turbidity is similar to or better than Site runoff, and then it may be combined with Site runoff and treated as described above.
   b. Process Water:
      1) Do not discharge high pH process water or wastewater (nonstormwater) that is generated onsite, including water generated during concrete grinding, rubblizing, washout, and hydrodemolition activities, to waters of the State of Oregon or United States, including wetlands. Water may be infiltrated upon approval of Engineer. Offsite disposal of concrete process water is subject to approval of Engineer.
      2) Treat all water generated onsite from construction or washing activities that is more turbid than Site runoff separately until turbidity is the same or less than Site runoff, and then it may be combined with Site runoff and treated as described above. Water may be infiltrated upon approval of Engineer.
   c. Offsite Water: Prior to disruption of normal watercourse, intercept offsite stormwater and pipe it either through or around the Project Site. This water shall not be combined with onsite stormwater. Discharge offsite water at its preconstruction outfall point preventing an increase in erosion below the Site. Submit proposed method for performing this Work for Engineer’s approval.

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L. Dispersion/Infiltration: Convey water only to dispersion or infiltration areas designated in the TESC Plan or to sites approved by Engineer. Water shall be conveyed to designated dispersion areas at a rate such that, when runoff leaves the area and enters waters of the State of Oregon or United States turbidity standards are achieved. Convey water to designated infiltration areas at a rate that does not produce surface runoff.

M. Detention/Retention Pond Construction: Whether permanent or temporary, construct before beginning other grading and excavation Work in the area that drains into that pond. Install temporary conveyances concurrently with grading in accordance with the TESC Plan so that newly graded areas drain to the pond as they are exposed.

N. Pollution Control:

1. Use BMPs to prevent or minimize stormwater exposure to pollutants from spills; vehicle and equipment fueling, maintenance, and storage; other cleaning and maintenance activities; and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. Implement the following BMPs when applicable:
   a. Written spill prevention and response procedures.
   b. Employee training on spill prevention and proper disposal procedures.
   c. Spill kits in all vehicles.
   d. Regular maintenance schedule for vehicles and machinery.
   e. Material delivery and storage controls.
   f. Training and signage.
   g. Covered storage areas for waste and supplies.

O. If Engineer orders the Work suspended, continue to control erosion, pollution, and runoff during the shutdown.

P. Nothing in this section shall relieve Contractor from complying with other Contract requirements.

1.04 SUBMITTALS

A. Informational Submittals:

1. When a TESC Plan is included on Drawings, either adopt or modify the TESC Plan. Provide a schedule for TESC Plan implementation and incorporate it into Contractor’s progress schedule. Obtain Engineer’s approval of the TESC Plan and schedule before any Work begins.

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2. Modified TESC Plans shall meet all requirements of the applicable jurisdictions.
3. The TESC Plan shall cover all areas that may be affected inside and outside the limits of the Project (including all Owner-provided sources, disposal sites, and haul roads, and all nearby land, streams, and other bodies of water).
4. Allow at least 5 working days for Engineer to review any original or revised TESC Plan. Failure to approve all or part of any such Plan shall not make Owner liable to Contractor for any Work delays.

PART 2 PRODUCTS

2.01 COMPOST BLANKET

A. Composed of products resulting from the biological degradation and transformation of plant-derived materials under controlled conditions designed to promote aerobic decomposition and:

1. Stable in oxygen consumption and carbon dioxide generation.
2. Mature and suitable for serving as a soil amendment or an erosion control BMP.
3. Appropriate in Moisture Content: No visible free water or dust produced when handling material.
4. Test compost products in accordance with U.S. Composting Council Testing Methods for the Examination of Compost and Composting (TMECC) 02.02-B, “Sample Sieving for Aggregate Size Classification.”

B. Meet the following criteria for Coarse Compost:

1. Gradation:

Sieve Size	Percent Passing	
	Minimum	**Maximum**
3"	100	
1"	90	100
3/4"	70	100
1/4"	40	60
Maximum particle length of 6 inches.		

2. pH: Between 6.0 and 8.5 when tested in accordance with U.S. Composting Council TMECC 04.11-A, “1:5 Slurry pH”.

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3. Manufactured Inert Material (Plastic, Concrete, Ceramics, Metal, etc.): Less than 1.0 percent by weight per U.S. Composting Council TMECC 03.08-A “Classification of Inerts by Sieve Size”.
4. Minimum Organic Matter: 40 percent by dry weight basis as determined by U.S. Composting Council TMECC 05.07A “Loss-On-Ignition Organic Matter Method (LOI)”.
5. Soluble Salt Content: Less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 “Electrical Conductivity”.
6. Maturity: Greater than 80 percent in accordance with U.S. Composting Council TMECC 05.05-A, “Germination and Root Elongation”.
7. Stability: 7 mg CO2–C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B “Carbon Dioxide Evolution Rate”.
8. The compost product must originate a minimum of 65 percent by volume from recycled plant waste. A maximum of 35 percent by volume of feedstocks, source-separated food waste, and/or biosolids may be substituted for recycled plant waste. Provide a list of feedstock sources by percentage in final compost product.
9. Engineer may evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E “Solvita® Maturity Index”. Coarse Compost shall score a 5 or above on the Solvita® Compost Maturity Test.

2.02 EROSION CONTROL BLANKET (MATTING), BIODEGRADABLE

A. Temporary erosion control blanket shall be made of natural plant fibers. Supply independent test results meeting the following:

Properties	ASTM Test Method	Requirements
Protecting Slopes from Rainfall-Induced Erosion	D6459: Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle.	Maximum C factor of 0.15 using Revised Universal Soil Loss Equation (RUSLE)
Dry Weight per Unit Area	D6475	0.36 lb/sq. yd. minimum
Performance in Protecting Earthen Channels from Stormwater-Induced Erosion	D6460: Test in one soil type. Soil tested shall be loam as defined by the NRCS Soil Texture Triangle.	1.0 lb/sq. ft. minimum

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Properties	ASTM Test Method	Requirements
Seed Germination Enhancement	D7322	200 percent minimum
Netting, if present, shall be biodegradable with a life span not to exceed 1 year.		

B. Permanent erosion control blankets shall be Type D slope protection mat, and shall be on the Oregon Department of Transportation Quality Products List (QPL).

2.03 GEOTEXTILE

A. Geotextiles shall consist only of long chain polymeric fibers or yarns formed into a stable network such that the fibers or yarns retain their position relative to each other during handling, placement, and design service life. At least 95 percent by weight of the material shall be polyolefins or polyesters. The material shall be free from defects or tears. Geotextile shall also be free of any treatment or coating which might adversely alter its hydraulic or physical properties after installation. Geotextile properties shall be as described in Table 1 through Table 3.

Table 1
Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Nonwoven	Woven	Nonwoven	Woven	Nonwoven
AOS	D4751	See Table 2		See Table 2		U.S. No. 30 max.	
Water Permittivity	D4491	See Table 2		See Table 2		0.02 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	250 lb min.	160 1b min.	315 lb min.	200 lb min.	250 lb min.	160 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	15% -50%	≥50%	15% -50%	≥50%	<50%	≥50%
Seam Breaking Strength	D4632/ D4632M	220 lb min.	140 lb min.	270 lb min.	180 lb min.	220 lb min.	140 lb min.
Puncture Resistance	D6241	495 lb min.	310 lb min.	620 lb min.	430 lb min.	495 lb min.	310 lb min.

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Table 1
Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements					
		Permanent Erosion Control				Ditch Lining	
		Moderate Survivability		High Survivability			
		Woven	Nonwoven	Woven	Nonwoven	Woven	Nonwoven
Tear Strength, in machine and x-machine direction	D4533	80 lb min.	50 lb min.	112 lb min.	79 lb min.	80 lb min.	50 lb min.
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device					

Table 2
Filtration Properties for Geotextile for Permanent Erosion Control

Geotextile Property	ASTM Test Method	Geotextile Property Requirements		
		Class A	Class B	Class C
AOS	D4751	U.S. No. 40 max.	U.S. No. 60 max.	U.S. No. 70 max.
Water Permittivity	D4491	0.7 sec^{-1} min.	0.4 sec^{-1} min.	0.2 sec^{-1} min.

Table 3
Geotextile for Temporary Silt Fence

Geotextile Property	ASTM Test Method	Geotextile Property Requirements	
		Unsupported Between Posts	Supported Between Posts with Wire or Polymeric Mesh
AOS	D4751	U.S. No. 30 max. for silt wovens, U.S. No. 50 for all other geotextile types, U.S. No. 100 min.	
Water Permittivity	D4491	0.2 sec^{-1} min.	
Grab Tensile Strength, in machine and x-machine direction	D4632/ D4632M	180 lb min. in machine direction, 100 lb min. in x-machine direction	100 lb min.
Grab Failure Strain, in machine and x-machine direction	D4632/ D4632M	30% max. at 180 lb or more	

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Table 3 Geotextile for Temporary Silt Fence			
		Geotextile Property Requirements	
Geotextile Property	ASTM Test Method	Unsupported Between Posts	Supported Between Posts with Wire or Polymeric Mesh
Ultraviolet (UV) Radiation Stability	D4355	70% strength retained min., after 500 hours in xenon arc device	

2.04 WOOD CHIP OR COMPOST FOR BIOFILTER BAG

A. Wood Chips: As specified in Article Wood Chips and Wood Shavings.

B. Compost: Coarse compost as specified in Article Compost Blanket.

2.05 CLEARING LIMIT FENCE

A. High Visibility Fence: UV stabilized, orange, high-density polyethylene, or polypropylene mesh.

B. Height: 4 feet minimum.

C. Support Posts: Wood or steel with sufficient strength and durability to support the fence through the life of the Project.

2.06 INLET PROTECTION

A. As specified under Article Geotextile.

2.07 MULCH

A. Short-Term: Provide independent test results documenting that the mulch meets the requirements in Table 4, Short-Term Mulch Test Requirements.

Table 4 Short-Term Mulch Test Requirements		
Properties	Test Method	Requirements
Performance in Protecting Slopes from Rainfall-Induced Erosion	ASTM D6459. Test in one soil type. Soil tested shall be sandy loam as defined by the National Resources Conservation Service (NRCS) Soil Texture Triangle	C Factor = 0.15 maximum using Revised Universal Soil Loss Equation (RUSLE)

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B. Moderate-Term: Within 48 hours of application, the Moderate-Term Mulch shall bond with soil surface to create a continuous, absorbent, flexible, erosion-resistant blanket that allows for seed germination and plant growth and conforms to the requirements in Table 5, Moderate-Term Mulch Test Requirements. Provide test results documenting that the mulch meets the requirements in Table 5, Moderate-Term Mulch Test Requirements. Supply independent test results.

Table 5
Moderate-Term Mulch Test Requirements

Properties	Test Method	Requirements
Performance in Protecting Slopes from Rainfall-Induced Erosion	ASTM D6459. Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle	C Factor = 0.05 maximum using Revised Universal Soil Loss Equation (RUSLE)

C. Long-Term:

1. Provide Long-Term Mulch with demonstrated ability:
   a. To adhere to soil and create a blanket-like mass within 2 hours of application.
   b. To bond with the soil surface to create a continuous, porous, absorbent, and flexible erosion-resistant blanket that allows for seed germination and plant growth.
   c. To conform to the requirements in Table 6, Long-Term Mulch Test Requirements.
   d. Provide test results documenting that mulch meets requirements in Table 6, Long-Term Mulch Test Requirements. Supply independent test results.

Table 6
Long-Term Mulch Test Requirements

Properties	Test Method	Requirements
Performance in Protecting Slopes from Rainfall-Induced Erosion	ASTM D6459. Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle	C Factor = 0.01 maximum using Revised Universal Soil Loss Equation (RUSLE)

2.08 PLASTIC COVERING

A. Clear plastic meeting requirements of ASTM D4397 for polyethylene sheeting having a minimum thickness of 6 mils.

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2.09 POLYACRYLAMIDE (PAM)

A. Meet ANSI/NSF Standard 60 for drinking water treatment with an AMD content not to exceed 0.05 percent.

B. Anionic, linear, and not cross-linked.

C. Minimum average molecular weight greater than 5 mg/mole and minimum 30 percent charge density.

D. 80 percent active ingredients minimum with moisture content not exceeding 10 percent by weight.

E. Delivered in a dry granular or powder form.

2.10 SEEDING

A. See Section 32 92 00, Turf and Grasses.

2.11 SILT (SEDIMENT) FENCE

A. Geotextile: As specified in Article Geotextile.

B. Support Posts: As recommended by manufacturer of geotextile.

C. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.12 STABILIZED CONSTRUCTION ENTRANCE

A. Construct a pad from stone 3 inches to 6 inches in size, placed at least 8 inches deep and not less than 50 feet long.

B. Provide aggregate free of extraneous materials that may cause or contribute to track out.

C. Place separation geotextile under the rock to prevent fine sediment from pumping up into the rock pad. See Article Geotextile for required geotextile properties.

D. Use of constructed or constructed/manufactured steel plates with ribs (such as, shaker/rumble plates or corrugated steel plates) for entrance/exit access is allowable.

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2.13 STRAW

A. Straw:

1. Air dried condition free of noxious weeds, seeds, and other materials detrimental to plant life. Hay is not acceptable. Provide weed-free documentation:
   a. Certified Weed Free Straw using North American Weed Management Association (NAWMA) standards.
   b. Provide documentation that material is steam or heat treated to kill seeds.
   c. Provide U.S. or state's Department of Agriculture laboratory test reports, dated within 90 days prior to date of application, showing there are no viable seeds in the straw.

B. Straw Mulch: Suitable for spreading with mulch blower equipment.

C. Posts for Straw Bales: 2-inch by 2-inch untreated wood or commercially manufactured metal posts.

2.14 STREET CLEANING

A. Use self-propelled pickup street sweeper(s). Mechanical broom sweepers are not allowed where environmental concerns exist about storm water pollution or air quality.

2.15 TEMPORARY CURB

A. Temporary curbs may consist of asphalt, concrete, sandbags, compost socks, wattles, or geotextile/plastic encased berms of sand or gravel, or as approved by Engineer.

2.16 TACKIFIERS

A. Biodegradable Hydraulically Applied Erosion Control Products (HECPs) in a dry condition, free of noxious weeds, seeds, chemical printing ink, germination inhibitors, herbicide residue, chlorine bleach, rock, metal, plastic, and other materials detrimental to plant life. Up to 5 percent by weight may be photodegradable material.

B. Suitable for spreading with a hydroseeder.

C. Furnish HECPs premixed by the manufacturer. Under no circumstances will field mixing of additives or components be acceptable.

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D. Provide test results, dated within 3 years prior to the date of application, from an independent, accredited laboratory, as approved by Engineer, showing that the product meets the HECP requirements in Table 7.

Table 7
HECP Requirements

Properties	Test Method	Requirements
Acute Toxicity	EPA-821-R-02-012 Methods for Measuring Acute Toxicity of Effluents. Test leachate from recommended application rate receiving 2 inches of rainfall per hour using static test for No-Observed-Adverse-Effect-Concentration (NOEC).	Four replicates are required with no statistically significant reduction in survival in 100 percent leachate for a Daphnid at 48 hours and Oncorhynchus mykiss (rainbow trout) at 96 hours.
Solvents	EPA-8260B	Benzene: < 0.03 mg/kg Methylene chloride: < 0.02 mg/kg Naphthalene: < 5 mg/kg Tetrachloreoethylene: < 0.05 mg/kg Toluene: < 7 mg/kg Trichloroethylene: < 0.03 mg/kg Xylenes: < 9 mg/kg
Heavy Metals	EPA-6020A Total Metals	Antimony: < 4 mg/kg Arsenic: < 6 mg/kg Barium: < 80 mg/kg Boron: < 100 mg/kg Cadmium: < 2 mg/kg Chromium: < 2 mg/kg Copper: < 5 mg/kg Lead: < 5 mg/kg Mercury: < 2 mg/kg Nickel: < 2 mg/kg Selenium: < 10 mg/kg Strontium: < 30 mg/kg Zinc: < 5 mg/kg

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Table 7
HECP Requirements

Properties	Test Method	Requirements
Water Holding Capacity	ASTM D7367	900 percent minimum
Organic Matter Content	ASTM D2974	90 percent minimum
Moisture Content	ASTM D2974	15 percent
Seed Germination Enhancement	ASTM D7322	Long-Term: 420 percent minimum Moderate-Term: 400 percent minimum Short-Term: 200 percent minimum

2.17 WATTLES FOR BIOFILTER BAGS

A. Cylinders of biodegradable plant material such as weed-free straw, coir, compost, wood chips, excelsior, or wood fiber or shavings encased within biodegradable netting.

B. Diameter: 5 inches minimum.

C. Netting Material: Clean, evenly woven, and free of encrusted concrete or other contaminating materials such as preservatives. Also free from cuts, tears, or weak places with a minimum lifespan of 6 months.

D. Compost Filler: Coarse compost, wood chips, or wood shavings.

E. Wood Stakes: Untreated softwood species, 2-inch by 2-inch nominal dimension and 36 inches in length.

2.18 WOOD CHIPS AND WOOD SHAVINGS

A. Wood Chips:

1. Derived from softwood species not containing resin, tannin, or other compounds in quantities that would be detrimental to plant life, and meeting the following loose volume gradation:
   a. 2-inch Sieve Size: 95 percent to 100 percent passing.
   b. No. 4 Sieve Size: 0 percent to 30 percent passing.

B. Wood Shavings: Provide shavings with 80 percent of the fibers 6 inches or longer between 0.030 inch wide and 0.50 inch wide, and between 0.017 inch thick and 0.13 inch thick.

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PART 3 EXECUTION

3.01 PREPARATION

A. Engineer's acceptance of the TESC Plan is required prior to starting earth disturbing activities.

B. Include proposed stockpile areas and installation of temporary erosion control devices, ditches, or other facilities in Work phasing plans.

C. Areas designated for Contractor's use during Project may be temporarily developed as specified to provide working, staging, and administrative areas. Include control of sediment from these areas in the TESC Plan.

D. Compost Blanket: Place compost blanket to a depth of 3 inches over bare soil prior to seeding or other planting. Place an organic tackifier over entire composted area when dry or windy conditions are present or expected before final application of mulch or erosion control blanket. Apply tackifier immediately after compost application to prevent compost from leaving area.

E. Erosion Control Blanket (Matting), Biodegradable: Temporary Erosion Control Blankets are used as an erosion prevention device and to enhance establishment of vegetation. Install erosion control blankets according to manufacturer's recommendations.

1. Erosion control blankets with an open area of 60 percent or greater may be installed prior to seeding and fertilizing. Install blankets with less than 60 percent open space immediately following seeding and fertilizing operation.
2. Select erosion control blanket material for an area based on the intended function; slope or ditch stabilization and Site-specific factors including soil, slope gradient, rainfall, and flow exposure. Do not use erosion Control Blankets on slopes or in ditches that exceed manufacturer's recommendations.
3. Install permanent erosion control blanket per Oregon Department of Transportation Standard Specification 280.44 (e).

F. Wood Chip or Compost Berm: Construct filter berms to retain sediment and direct flows.

1. Wood Chip Berm: 2-foot minimum height. Maintain at this height for entire time berm is in use.
2. Construct compost berm of course compost in accordance with the detail on Drawings.

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G. High Visibility Fencing: Install high visibility fencing in accordance with Drawings.

H. Mulch: Furnish, haul, and evenly apply at rates indicated and spread on seeded areas within 48 hours after seeding unless otherwise specified.

1. Distribute straw mulch material with an approved mulch spreader that uses forced air to blow mulch material on seeded areas.
2. Apply wood strand mulch by hand or by straw blower on seeded areas.
3. Hydraulically apply Short-Term Mulch at the rate of 2,500 pounds per acre. May be applied in one lift.
4. Hydraulically apply Moderate-Term Mulch and Long-Term Mulch at the rate of 3,500 pounds per acre with no more than 2,000 pounds applied in any single lift. Mulch may be applied with seed and fertilizer in moist climates. In dry climates, apply seed and fertilizer in a single application followed by mulch application. Provide mulch suitable for application with a hydroseeder.
5. Cover temporary seed applied outside application windows established in Section 32 92 00, Turf and Grasses, with a mulch containing either Moderate-Term Mulch or Long-Term Mulch, as designated by Engineer.
6. Mulch areas not accessible by mulching equipment by approved hand.

I. Plastic Covering: Use clear plastic covering to promote seed germination when seeding is performed outside of specified dates. Use black plastic covering for stockpiles or other areas where vegetative growth is unwanted. Place plastic with at least a 12-inch overlap of all seams. Install and maintain plastic cover to prevent water from cutting under the plastic and to prevent cover from blowing open in the wind.

J. Polyacrylamide (PAM): See Tackifiers.

K. Sediment Control Barriers: Install sediment control barriers in accordance with TESC Plan or manufacturer’s recommendations in the areas of clearing, grubbing, earthwork, or drainage prior to starting those activities. Maintain sediment control barriers until soils are stabilized.

L. Seeding: See Section 32 92 00, Turf and Grasses.

M. Silt (Sediment) Fence:

1. Silt fence shall be installed in accordance with Drawings. When backup support is used, use steel wire with a maximum mesh spacing of 2 inches by 4 inches, or plastic mesh as resistant to ultraviolet radiation as the geotextile it supports. Provide wire or plastic mesh with strength

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equivalent to or greater than as required for unsupported geotextile (for example, 180 pounds grab tensile strength in the machine direction).

2. Attach geotextile to posts and support system using staples, wire, or in accordance with manufacturer's recommendations. Geotextile shall be sewn together at the point of manufacture, or at a location approved by Engineer, to form geotextile lengths as required.
3. Provide wood or steel support posts at sewn seams and overlaps and as shown on Drawings and necessary to support fence.
4. Wood Posts: Minimum dimensions of 1-1/4-inch by 1-1/4-inch by the minimum length shown on Drawings.
5. Steel Posts: Minimum weight of 0.90 lb/ft.
6. When sediment deposits reach approximately one-third the height of the silt fence, remove and stabilize deposits.

N. Stabilized Construction Entrance: Construct temporary stabilized construction entrance in accordance with Drawings, prior to beginning any clearing, grubbing, earthwork, or excavation. When stabilized entrance no longer prevents track out of sediment or debris, either rehabilitate existing entrance to original condition or construct a new entrance.

O. Street Cleaning: Use self-propelled pickup street sweepers whenever required by Engineer to prevent transport of sediment and other debris off Project Site. Provide street sweepers designed and operated to meet air quality standards. Street washing with water will require approval by Engineer. Intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

P. Tackifiers:

1. Mix and apply tackifier in accordance with manufacturer's recommendations. If applied with a hydroseeder, add Short-Term Mulch as a tracer at a rate of 125 pounds to 250 pounds per acre to visibly aid uniform application.
2. Soil Binding Using Polyacrylamide (PAM): Apply PAM on bare soil completely dissolved and mixed in water or applied as a dry powder. Apply dissolved PAM at a rate of not more than 2/3 pound per 1,000 gallons of water per acre. Apply a minimum of 200 pounds per acre of Short-Term Mulch with the dissolved PAM. Dry powder

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applications may be at a rate of 5 pounds per acre using a hand-held fertilizer spreader or a tractor-mounted spreader.

a. Apply PAM only to areas that drain to completed sedimentation control BMPs in accordance with the TESC Plan. PAM may be reapplied on actively worked areas after a 48-hour period.
b. PAM shall not be applied during rainfall or to saturated soils.

Q. Temporary Curb: Provide temporary curbs to divert or redirect water around erodible soils. Temporary curbs shall be installed along pavement edges to prevent runoff from flowing onto erodible slopes. Water shall be directed to areas where erosion can be controlled. Temporary curbs shall be a minimum of 4 inches in height. Ponding shall not be in roadways.

R. Wood Chips and Wood Shavings: Install in biofilter bags in accordance with Drawings.

3.02 ADDITIONAL REQUIREMENTS

A. Natural Buffer or Equivalent:

1. Unless natural buffer between the Project Site and receiving waters has previously been eliminated by pre-existing development disturbances, comply with one of the following alternatives if stormwater from construction will discharge to surface water:
   a. Provide a 50-foot, undisturbed natural buffer between construction disturbances and surface water.
   b. Provide an undisturbed natural buffer that is less than 50 feet supplemented by additional erosion and sediment controls, which in combination, achieve a sediment load reduction that is equivalent to a 50-foot buffer.
   c. If it is infeasible to provide an undisturbed natural buffer of any size, implement erosion and sediment controls that achieve a sediment load reduction that is equivalent to a 50-foot buffer.

3.03 MAINTENANCE

A. The ESCP measures described in this specification are minimum requirements for anticipated Site conditions. During the construction period, upgrade these measures as needed to comply with all applicable local, state, and federal erosion and sediment control regulations.

B. Maintain erosion and sediment control BMPs so they properly perform their function until Engineer determines they are no longer needed.

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C. Construction activities must avoid or minimize excavation and creation of bare ground during wet weather.

D. The intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

E. Inspect BMPs in accordance with the schedule in the Construction Stormwater Discharge Permit(s) or as directed by Engineer.

F. Complete an inspection report within 24 hours of an inspection. Each inspection report shall be signed and identify corrective actions. Document that corrective actions are performed within 7 days of identification. Keep a copy of all inspection reports at the Site or at an easily accessible location.

G. Unless otherwise specified, remove deposits before the depth of accumulated sediment and debris reaches approximately height of BMP. Dispose of debris or contaminated sediment at approved locations. Clean sediments may be stabilized onsite using BMPs as approved by Engineer.

H. Sediment Fence: Remove trapped sediment before it reaches one-third of the above ground fence height and before fence removal.

I. Other Sediment Barriers (such as biobags): Remove sediment before it reaches 2 inches depth above ground height and before BMP removal.

J. Catch Basins: Clean before retention capacity has been reduced by 50 percent.

K. Initiate repair or replacement of damaged erosion and sediment control BMPs immediately, and work completed by end of next workday. Significant replacement or repair must be completed within 7 days, unless infeasible.

L. Within 24 hours, remediate any significant sediment that has left construction site. Investigate cause of the sediment release and implement steps to prevent a recurrence of discharge within same 24 hours. Perform in-stream cleanup of sediment according to applicable regulations.

M. At end of each workday, stabilize or cover soil stockpiles or implement other BMPs to prevent discharges to surface waters or conveyance systems leading to surface waters.

N. Temporarily stabilize soils at end of shift before holidays and weekends, if needed. Ensure soils are stable during rain events at all times of year.

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O. Initiate stabilization by no later than end of next workday after construction work in an area has stopped permanently or temporarily.

P. Within 14 days of initiating stabilization or as specified in permit, either seed or plant stabilized area (see Section 32 92 00, Turf and Grasses); or apply non-vegetative measures and cover all areas of exposed soil. Seed dry areas as soon as Site conditions allow. Ensure that vegetation covers at least 70 percent of stabilized area. In areas where Contractor's activities have compromised erosion control functions of existing grasses, overseed existing grass. Non-vegetative measures may include blown straw and a tackifier, loose straw, or an adequate covering of compost mulch. Complete initial stabilization within 7 days if storm water discharges to surface waters impaired for sediment or nutrients, or high quality waters.

Q. Provide permanent erosion control measures on all exposed areas. Do not remove temporary sediment control practices until permanent vegetation or other cover of exposed areas is established. However, do remove all temporary erosion control measures as exposed areas become stabilized, unless doing so conflicts with local requirements. Properly dispose of construction materials and waste, including sediment retained by temporary BMPs.

3.04 EMERGENCY MATERIALS

A. Provide, stockpile, and protect the following emergency erosion and sediment control materials on the Project Site for unknown weather or erosion conditions. Emergency materials are in addition to other erosion control materials required to implement and maintain the TESC Plan. Replenish emergency materials as they are used. Remove all unused emergency materials from the Project Site at completion of the Project.

Item	Quantity
Silt (sediment) fence	100 ft
Plastic sheeting	260 sq. ft.
Rope	1,000 ft
Sandbags (empty, to be filled as needed)	50
Straw bales	10
Biofilter bags (with stakes)	10

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3.05 REMOVAL

A. When Engineer determines that an erosion control BMP is no longer required, remove BMP and all associated hardware from the Project limits. When materials are biodegradable, Engineer may approve leaving temporary BMP in place.

B. Permanently stabilize all bare and disturbed soil after removal of erosion and sediment control BMPs. Dress sediment deposits remaining after BMPs have been removed to conform to existing grade. Prepare and seed graded area. If installation and use of erosion control BMPs have compacted or otherwise rendered soil inhospitable to plant growth, such as construction entrances, take measures to rehabilitate soil to facilitate plant growth. This may include, but is not limited to, ripping the soil, incorporating soil amendments, or seeding with specified seed.

END OF SECTION

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SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Products:

1. New items for incorporation in the Work, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock, and may also include existing materials or components required for reuse.
2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
3. Items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.02 DESIGN REQUIREMENTS

A. Where Contractor design is specified, design of installation, systems, equipment, and components, including supports and anchorage, shall be in accordance with provisions of latest edition of International Building Code (IBC) by International Code Council.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Altitude: Provide materials and equipment suitable for installation and operation under rated conditions at 100 feet above sea level.

B. Provide equipment and devices installed outdoors or in unheated enclosures capable of continuous operation within an ambient temperature range of 0 degrees F to 105 degrees F.

1.04 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

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B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:

1. Furnish as required by individual specifications.
2. Schedule:
    a. Ensure that shipment and delivery occur concurrent with shipment of associated equipment.
    b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
3. Packaging and Shipment:
    a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.
    b. Prominently displayed on each package, the following:
        1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
        2) Applicable equipment description.
        3) Quantity of parts in package.
        4) Equipment manufacturer.
4. Deliver materials to Site.
5. Notify Engineer upon arrival for transfer of materials to Owner.
6. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.

D. Request a minimum 7-day advance notice of shipment from manufacturer. Upon receipt of manufacturer's advance notice of shipment, promptly notify Engineer of anticipated date and place of arrival.

E. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual specification sections.

1.05 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver

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anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.06 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01 50 00, Temporary Facilities and Controls. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.

B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.

E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

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F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.

H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual specifications.

B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.

C. When manufacturer's product model has been superseded by another commercially-available product model from same manufacturer, provide the latest model of product.

D. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.

E. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

F. Provide interchangeable components of the same manufacturer, for similar components, unless otherwise specified.

G. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.

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H. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.

I. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

J. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark.

K. Equipment Finish:

1. Provide manufacturer’s standard finish and color, except where specific color is indicated.
2. If manufacturer has no standard color, provide equipment with gray finish as approved by Engineer.

L. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance.

M. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

N. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the

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maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 FABRICATION AND MANUFACTURE

A. General:

1. Manufacture parts to U.S.A. standard sizes and gauges.
2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
3. Design structural members for anticipated shock and vibratory loads.
4. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
5. Modify standard products as necessary to meet performance specifications.

B. Lubrication Systems:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

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PART 3 EXECUTION

3.01 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor's control.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.

B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.

D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.03 INSTALLATION

A. Equipment drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer.

F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain a copy of manufacturers' instruction at Site, available for review at all times.

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G. For material and equipment specifically indicated or specified to be reused in the Work:

1. Use special care in removal, handling, storage, and reinstallation to assure proper function in the completed Work.
2. Arrange for transportation, storage, and handling of products that require offsite storage, restoration, or renovation. Include costs for such Work in the Contract Price.

3.04 FIELD FINISHING

A. In accordance with Section 09 90 00, Painting and Coating, and individual specification sections.

3.05 ADJUSTMENT AND CLEANING

A. Perform required adjustments, tests, operation checks, and other startup activities.

3.06 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

3.07 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is part of this specification.

1. Manufacturer’s Certificate of Compliance.

END OF SECTION

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MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: _____

PROJECT NAME: _____

PROJECT NO: _____

PRODUCT, MATERIAL, OR SERVICE SUBMITTED: _____

Comments: _____

_____

_____

_____

_____

_____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: _____, 20___

Manufacturer: _____

Manufacturer's Authorized Representative *(print)*: _____

_____

(Authorized Signature)

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SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Submit prior to application for final payment:
   a. Record Documents: As required in General Conditions.
   b. Approved Shop Drawings and Samples: As required in the General Conditions.
   c. Special bonds, Special Guarantees, and Service Agreements.
   d. Consent of Surety to Final Payment: As required in General Conditions.
   e. Releases or Waivers of Liens and Claims: As required in General Conditions.
   f. Releases from Agreements.
   g. Final Application for Payment: Submit in accordance with procedures and requirements stated in Article 15 of the General Conditions.
   h. Extra Materials: As required by individual specification sections.
   i. Documentation required to Support Owner's reporting requirements to Energy Trust of Oregon, related to incentive funding for portions of the Work.

1.02 RECORD DOCUMENTS

A. Quality Assurance:

1. Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
2. Accuracy of Records:
   a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
   b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive Site measurement, investigation, and examination.
3. Make entries within 24 hours after receipt of information that a change in the Work has occurred.

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4. Prior to submitting each request for progress payment, request Engineer's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by Engineer to recommend whole or any part of Contractor's Application for Payment, either partial or final.

1.03 RELEASES FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.

B. In the event Contractor is unable to secure written releases:

1. Inform Owner of the reasons.
2. Owner or its representatives will examine the Site, and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
3. Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price, or require Contractor to furnish a satisfactory bond in a sum to cover legal Claims for damages.
4. When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if: (i) Contractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate Claims that Contractor has failed to fulfill terms of side agreement or special easement, or (ii) Contractor is unable to contact or has had undue hardship in contacting grantor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS

A. General:

1. Promptly following commencement of Contract Times, secure from Engineer at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
2. Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.

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3. Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded.

B. Preservation:

1. Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
2. Make documents and Samples available at all times for observation by Engineer.

C. Making Entries on Drawings:

1. Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
    a. Color Coding:
        1) Green when showing information deleted from Drawings.
        2) Red when showing information added to Drawings.
        3) Blue and circled in blue to show notes.
2. Date entries.
3. Call attention to entry by “cloud” drawn around area or areas affected.
4. Legibly mark to record actual changes made during construction including, but not limited to:
    a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
    b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
    c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
    d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
    e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, and Engineer’s written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.

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5. Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
    a. Clearly identify the item by accurate note such as “cast iron drain,” “galv. water,” and the like.
    b. Show, by symbol or note, vertical location of item (“under slab,” “in ceiling plenum,” “exposed,” and the like).
    c. Make identification so descriptive that it may be related reliably to Specifications.

3.02 FINAL CLEANING

A. At completion of the Work or of a part thereof and immediately prior to Contractor’s request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor’s notice of completion, clean entire Site, or parts thereof, as applicable.

1. Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner and Engineer.
2. Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
3. Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
4. Broom clean exterior paved driveways and parking areas.
5. Hose clean sidewalks, loading areas, and others contiguous with principal structures.

B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

END OF SECTION

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SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Data, as required by individual specification sections.

1.02 DEFINITIONS

A. Final Data: Engineer-accepted data, submitted as specified herein.

B. Maintenance Operation: As used on Maintenance Summary Form is defined to mean any routine operation required to ensure satisfactory performance and longevity of equipment. Examples of typical maintenance operations are lubrication, belt tensioning, adjustment of pump packing glands, and routine adjustments.

C. Preliminary Data: Initial and subsequent submissions for Engineer's review.

1.03 SEQUENCING AND SCHEDULING

A. Equipment and System Data:

1. Preliminary Data:
   a. Do not submit until Shop Drawing for equipment or system has been reviewed and approved by Engineer.
   b. Submit prior to shipment date.
   c. Submit preliminary data for all equipment and systems prior to 50 percent point of completion of the Work.
2. Final Data: Submit Instructional Manual Formatted data not less than 30 days prior to installation of equipment or system field functional testing. Submit Compilation Formatted and Electronic Media Formatted data prior to Substantial Completion of Project.

B. Materials and Finishes Data:

1. Preliminary Data: Submit at least 15 days prior to request for final inspection.
2. Final Data: Submit within 10 days after final inspection.

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1.04 DATA FORMAT

A. Prepare preliminary and final data in the form of an instructional manual. Prepare final data in data compilation format and on electronic media.

B. Instructional Manual Format:

1. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
2. Size: 8-1/2 inches by 11 inches, minimum.
3. Cover:
    a. Identify manual with typed or printed title “OPERATION AND MAINTENANCE DATA” and list:
        1) Project title.
        2) Designate applicable system, equipment, material, or finish.
        3) Identity of separate structure as applicable.
        4) Identify volume number if more than one volume.
        5) Identity of general subject matter covered in manual.
        6) Identity of equipment number and specification section.
4. Spine:
    a. Project title.
    b. Identify volume number if more than one volume.
5. Title Page:
    a. Contractor name, address, and telephone number.
    b. Subcontractor, Supplier, installer, or maintenance contractor’s name, address, and telephone number, as appropriate.
        1) Identify area of responsibility of each.
        2) Provide name and telephone number of local source of supply for parts and replacement.
6. Table of Contents:
    a. Neatly typewritten and arranged in systematic order with consecutive page numbers.
    b. Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
7. Paper: 20-pound minimum, white for typed pages.
8. Text: Manufacturer’s printed data, or neatly typewritten.
9. Three-hole punch data for binding and composition; arrange printing so that punched holes do not obliterate data.
10. Material shall be suitable for reproduction, with quality equal to original. Photocopying of material will be acceptable, except for material containing photographs.

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C. Data Compilation Format:

1. Compile all Engineer-accepted preliminary O&M data into a hard-copy, hard-bound set.
2. Each set shall consist of the following:
   a. Binder: Commercial quality, permanent, three-ring or three-post binders with durable plastic cover.
   b. Cover:
      1) Identify each volume with typed or printed title "OPERATION AND MAINTENANCE DATA, VOLUME NO. ___ OF ___", and list:
         a) Project title.
         b) Contractor's name, address, and telephone number.
         c) If entire volume covers equipment or system provided by one Supplier include the following:
            (1) Identity of general subject matter covered in manual.
            (2) Identity of equipment number and specification section.
   c. Provide each volume with title page and typed table of contents with consecutive page numbers. Place contents of entire set, identified by volume number, in each binder.
   d. Table of contents neatly typewritten, arranged in a systematic order:
      1) Include list of each product, indexed to content of each volume.
      2) Designate system or equipment for which it is intended.
      3) Identify each product by product name and other identifying numbers or symbols as set forth in Contract Documents.
   e. Section Dividers:
      1) Heavy, 80-pound cover weight, tabbed with numbered plastic index tabs.
      2) Fly-Leaf:
         a) For each separate product, or each piece of operating equipment, with typed description of product and major component parts of equipment.
         b) List with Each Product:
            (1) Name, address, and telephone number of Subcontractor, Supplier, installer, and maintenance contractor, as appropriate.
            (2) Identify area of responsibility of each.
            (3) Provide local source of supply for parts and replacement.
         c) Identity of separate structure as applicable.

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f. Assemble and bind material, as much as possible, in same order as specified in the Contract Documents.

D. Electronic Media Format:

1. Portable Document Format (PDF):
   a. Provide all PDF files with searchable text. Perform Optical Character Recognition (OCR) process on PDF files as required to provide searchable function. Perform de-speckle, de-skew, page rotation and other pre-processing actions as may be required to convert data to searchable text.
   b. After all preliminary data has been found to be acceptable to Engineer, submit Operation and Maintenance data in PDF format on CD.
   c. Files to be exact duplicates of Engineer-accepted preliminary data. Arrange by specification number and name.
   d. Files to be fully functional and viewable in most recent version of Adobe Acrobat.
2. Manufacturers' standard electronic format.

1.05 SUBMITTALS

A. Informational:

1. Data Outline: Submit electronic copies of a detailed outline of proposed organization and contents of Final Data prior to preparation of Preliminary Data.
2. Equipment Inventory Data:
   a. See Supplement "Equipment Inventory Template". Owner will use this data to populate Owner's computerized maintenance management system.
   b. Obtain digital (MS Excel) version of this template from Owner.
   c. Prepare and submit digital (MS Excel) data for all equipment, valves, and instruments.
   d. Continuously maintain current Equipment Inventory Data, following receipt of approved submittals for each equipment.
   e. Submit final Equipment Inventory Data for each unit process concurrent with Manufacturer's Certificate of Proper Installation (as applicable) and prior to Functional Testing Part 1 for the related unit process.
3. Preliminary Data:
   a. Submit for Engineer's review.
   b. If data meets conditions of the Contract, Engineer will respond noting such condition.

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c. If data does not meet conditions of the Contract:
   1) Submittal will be returned to Contractor with Engineer's comments for revision.
   2) Resubmit revised in accordance with Engineer's comments.

4. Final Data: Submit two copies and two CDs or DVDs in format specified herein.

1.06 DATA FOR EQUIPMENT AND SYSTEMS

A. Content For Each Unit (or Common Units) and System:

1. Product Data:
   a. Include only those sheets that are pertinent to specific product.
   b. Clearly annotate each sheet to:
      1) Identify specific product or part installed.
      2) Identify data applicable to installation.
      3) Identify or cross out references to inapplicable information.
   c. Function, normal operating characteristics, and limiting conditions.
   d. Performance curves, engineering data, nameplate data, and tests.
   e. Complete nomenclature and commercial number of replaceable parts.
   f. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.
   g. Spare parts ordering instructions.
   h. Where applicable, identify installed spares and other provisions for future work (such as reserved panel space, unused components, wiring, terminals).
2. As-installed, color-coded piping diagrams.
3. Charts of valve tag numbers, with the location and function of each valve.
4. Drawings:
   a. Supplement product data with Drawings as necessary to clearly illustrate:
      1) Format:
         a) Provide reinforced, punched, binder tab; bind in with text.
         b) Reduced to 8-1/2 inches by 11 inches, or 11 inches by 17 inches folded to 8-1/2 inches by 11 inches.
         c) Where reduction is impractical, fold and place in 8-1/2-inch by 11-inch envelopes bound in text.
         d) Identify specification section and product on Drawings and envelopes.

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b. Relations of component parts of equipment and systems.
c. Control and flow diagrams.
d. Coordinate drawings with Project record documents to assure correct illustration of completed installation.

5. Instructions and Procedures: Within text, as required to supplement product data.
   a. Format:
      1) Organize in consistent format under separate heading for each different procedure.
      2) Provide logical sequence of instructions for each procedure.
      3) Provide information sheet for Owner's personnel, including:
         a) Proper procedures in event of failure.
         b) Instances that might affect validity of guarantee or Bond.
   b. Installation Instructions: Including alignment, adjusting, calibrating, and checking.
   c. Operating Procedures:
      1) Startup, break-in, routine, and normal operating instructions.
      2) Test procedures and results of factory tests where required.
      3) Regulation, control, stopping, and emergency instructions.
      4) Description of operation sequence by control manufacturer.
      5) Shutdown instructions for both short and extended duration.
      6) Summer and winter operating instructions, as applicable.
      7) Safety precautions.
      8) Special operating instructions.
   d. Maintenance and Overhaul Procedures:
      1) Routine maintenance.
      2) Guide to troubleshooting.
      3) Disassembly, removal, repair, reinstallation, and re-assembly.
6. Guarantee, Bond, and Service Agreement: In accordance with Section 01 77 00, Closeout Procedures.

B. Content for Each Electric or Electronic Item or System:

1. Description of Unit and Component Parts:
   a. Function, normal operating characteristics, and limiting conditions.
   b. Performance curves, engineering data, nameplate data, and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
   d. Interconnection wiring diagrams, including control and lighting systems.

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2. Circuit Directories of Panelboards:
   a. Electrical service.
   b. Control requirements and interfaces.
   c. Communication requirements and interfaces.
3. List of electrical relay settings, and control and alarm contact settings.
4. Electrical interconnection wiring diagram, including as applicable, single-line, three-line, schematic and internal wiring, and external interconnection wiring.
5. As-installed control diagrams by control manufacturer.
6. Operating Procedures:
   a. Routine and normal operating instructions.
   b. Startup and shutdown sequences, normal and emergency.
   c. Safety precautions.
   d. Special operating instructions.
7. Maintenance Procedures:
   a. Routine maintenance.
   b. Guide to troubleshooting.
   c. Adjustment and checking.
   d. List of relay settings, and control and alarm contact settings.
8. Manufacturer’s printed operating and maintenance instructions.
9. List of original manufacturer’s spare parts, manufacturer’s current prices, and recommended quantities to be maintained in storage.

C. Maintenance Summary:

1. Compile individual Maintenance Summary for each applicable equipment item, respective unit, or system, and for components or sub-units.
2. Format:
   a. Use Maintenance Summary Form bound with this section or electronic facsimile of such.
   b. Each Maintenance Summary may take as many pages as required.
   c. Use only 8-1/2-inch by 11-inch size paper.
   d. Complete using typewriter or electronic printing.
3. Include detailed lubrication instructions and diagrams showing points to be greased or oiled; recommend type, grade, and temperature range of lubricants and frequency of lubrication.
4. Recommended Spare Parts:
   a. Data to be consistent with manufacturer’s Bill of Materials/Parts List furnished in O&M manuals.
   b. “Unit” is the unit of measure for ordering the part.
   c. “Quantity” is the number of units recommended.
   d. “Unit Cost” is the current purchase price.

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D. Equipment Inventory Data:

1. Compile individual Equipment Inventory Data for each applicable equipment item, respective unit, or system, and for components or sub-units.
2. Format:
   a. See attached supplement.
   b. Complete digitally using MS Excel 2010 or newer.
3. Coordinate with Owner to review required data format prior to initial submittal.

1.07 DATA FOR MATERIALS AND FINISHES

A. Content for Architectural Products, Applied Materials, and Finishes:

1. Manufacturer's data, giving full information on products:
   a. Catalog number, size, and composition.
   b. Color and texture designations.
   c. Information required for reordering special-manufactured products.
2. Instructions for Care and Maintenance:
   a. Manufacturer's recommendation for types of cleaning agents and methods.
   b. Cautions against cleaning agents and methods that are detrimental to product.
   c. Recommended schedule for cleaning and maintenance.

B. Content for Moisture Protection and Weather Exposed Products:

1. Manufacturer's data, giving full information on products:
   a. Applicable standards.
   b. Chemical composition.
   c. Details of installation.
2. Instructions for inspection, maintenance, and repair.

1.08 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. Maintenance Summary Form.
2. Equipment Inventory Template.

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PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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MAINTENANCE SUMMARY FORM

PROJECT: Tri-City WRRF Primary Clarifier Rehabilitation CONTRACT NO.:_____

1. EQUIPMENT ITEM_____
2. MANUFACTURER _____
3. EQUIPMENT/TAG NUMBER(S) _____
4. WEIGHT OF INDIVIDUAL COMPONENTS (OVER 100 POUNDS)_____
5. NAMEPLATE DATA (hp, voltage, speed, etc.) _____
6. MANUFACTURER'S LOCAL REPRESENTATIVE _____
    a. Name_____ Telephone No. _____
    b. Address _____
7. MAINTENANCE REQUIREMENTS

Maintenance Operation Comments	**Frequency**	**Lubricant (If Applicable)**
List briefly each maintenance operation required and refer to specific information in manufacturer's standard maintenance manual, if applicable. (Reference to manufacturer's catalog or sales literature is not acceptable.)	List required frequency of each maintenance operation.	Refer by symbol to lubricant required.

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8. LUBRICANT LIST

Reference Symbol	Valvoline	Exxon Mobil	Chevron Texaco	Petro-Canada	Or-Equal
List symbols used in No. 7 above.	List equivalent lubricants, as distributed by each manufacturer for the specific use recommended.				

9. RECOMMENDED SPARE PARTS FOR OWNER'S INVENTORY.

Part No.	Description	Unit	Quantity	Unit Cost
Note: Identify parts provided by this Contract with two asterisks.				

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EQUIPMENT INVENTORY TEMPLATE																				
Field Title	**Equipment Classification**	**Equipment Type**	**Operating Status**	**Plant**	**Area**	**System**	**Make**	**Model**	**Serial Number**	**Model Year**	**Size**	**Valve Operator**	**Asbuilt Drawing**	**AsBuilt ID**	**Purchase Amount**	**Purchase Date**	**Warranty Number/Description**	**Installed By**	**Start Date**	**Service Life**	**General Comment**
EXAMPLE	Pumps	Centrifugal	Operational	Tri-City	Aeration Basins	Aeration	ABS Pumps Inc.	ABC123	923874	2021	100 HP	Not Applicable	X-XX-123	Pump-101	$1,234	11/18/2021	No. 1234; 1-year from startup	Contractor	11/19/2021	15 years	

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SECTION 01 88 15
ANCHORAGE AND BRACING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for anchorage and bracing of equipment, distribution systems, and other nonstructural components required in accordance with the ICC 2018 International Building Code (IBC), for seismic, wind, gravity, soil, and operational loads.

1.02 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.

B. Designated Seismic System: Architectural, electrical, and mechanical system or their components for which component importance factor is greater than 1.0.

1.03 DESIGN AND PERFORMANCE REQUIREMENTS

A. General:

1. Anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Oregon.
2. Design anchorage into concrete, including embedment in accordance with ACI 318; Chapter 17 (or other industry standard approved by Engineer), and Project Specifications.
   a. Unless otherwise noted, design for cracked concrete condition.
3. Design anchorage and bracing of architectural, mechanical, and electrical components and systems in accordance with this section, unless a design is specifically provided within Contract Documents or where exempted hereinafter.
4. Design attachments, braces, and anchors for equipment, components, and distribution systems to structure for gravity, seismic, wind, and operational loading.

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5. Design seismic anchorage and bracing for modified existing mechanical, or electrical systems where code requirements would dictate design for similar new components.
6. Anchor and brace piping and ductwork, whether exempt or not exempt for this section, so that lateral or vertical displacement does not result in damage or failure to essential architectural, mechanical, or electrical equipment.
7. Provide supplementary framing where required to transfer anchorage and bracing loads to structure.
8. Adjust equipment pad sizes or provide additional anchorage confinement reinforcing to provide required anchorage capacities.
9. Design anchorage and bracing for:
    a. Equipment and components that weigh more than 400 pounds and are mounted 4 feet or less above adjacent finished floor.
    b. Equipment weighing more than 20 pounds that is mounted more than 4 feet above adjacent finished floor.
    c. Distribution systems that weigh more than 5 pounds per foot that are mounted more than 4 feet above adjacent finished floor.
10. For components exempted from design requirements of this section, provide bolted, welded, or otherwise positively fastened attachments to supporting structure.

B. Design Loads:

1. Gravity: Design anchorage and bracing for self-weight and superimposed loads on components and equipment.
2. Wind: Design anchorage and bracing for wind criteria provided below for exposed architectural components and exterior and wind-exposed mechanical and electrical equipment. Alternately, manufacturer certification may be provided for components such as roofing and flashing to verify attachments meet Project-specific design criteria.
    a. Wind Design Criteria:
        1) Wind Speed: 103 mph.
        2) Exposure: C.
        3) Risk Category: III.
3. Operational:
    a. For loading supplied by equipment manufacturer for IBC required load cases.
    b. Loads may include equipment vibration, torque, thermal effects, effects of internal contents (weight and sloshing), water hammer, and other load-inducing conditions.
    c. Locate braces to minimize vibration to or movement of structure.

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4. Seismic:
    a. In accordance with 2018 IBC, Section 1613, and Chapter 13 of ASCE 7.
    b. Design anchorage and bracing for design criteria listed below:
        1) Seismic Design Criteria:
            a) S_S = 0.84 g.
            b) S_1 = 0.374 g.
            c) Risk Category: III.
            d) Site Class: D.
    c. Design forces for anchors in concrete or masonry shall be in accordance with ASCE 7, Section 13.4.2, or IBC Section 1905.1.9 as applicable for Project Seismic Design Category.

C. Seismic Design Requirements:

1. Analyze local region of body of nonstructural component for load transfer of anchorage attachment if component Ip = 1.5.
2. Provide support drawings and calculations for electrical distribution components if any of the following conditions apply:
    a. Conduit diameter is greater than 2.5-inch trade size.
    b. Total weight of bus duct, cable tray, or conduit supported by trapeze assemblies exceeds 10 pounds per foot.
3. Existing components, systems, and equipment in their final condition that are modified by Project requirements and are not exempted by above paragraph require the same anchorage and bracing drawing and calculation submittals as new equipment. Field verify existing conditions.
4. Other seismic design and detailing information identified in ASCE 7, Chapter 13, is required to be provided for new and modified or noted mechanical and electrical components, systems, or equipment.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. List of architectural, mechanical, and electrical equipment requiring Contractor-designed anchorage and bracing, unless specifically exempted.
    b. Manufacturers' engineered seismic and non-seismic hardware product data.
    c. Attachment assemblies' drawings including seismic attachments; include connection hardware, braces, and anchors or anchor bolts for nonexempt components, equipment, and systems.

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d. List of existing architectural, mechanical, and electrical equipment or components to be modified in Project requiring Contractor-designed anchorage and bracing in final retrofitted condition.
e. Submittal will be rejected if proposed anchorage method would create excessive stress to supporting member. Revise anchorages and strengthen structural support to eliminate overstressed condition.

B. Informational Submittals:

1. Anchorage and Bracing Calculations: For attachments, braces, and anchorages, include IBC and Project-specific criteria as noted herein, in addition to manufacturer's specific criteria used for design; sealed by a civil engineer registered in the State of Oregon.
2. Manufacturer's hardware installation requirements.

1.05 SOURCE QUALITY CONTROL

A. Contractor and supplier responsibilities to accommodate Owner-furnished special inspections and testing are provided in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Provide all other specified, regulatory required, or required repair verification inspection and testing that is not listed in Statement of Special Inspections in accordance with Section 01 45 16.13, Contractor Quality Control.

PART 2 PRODUCTS

2.01 GENERAL

A. Design and construct attachments and supports transferring seismic and non-seismic loads to structure of materials and products suitable for application and in accordance with design criteria shown on Drawings and nationally recognized standards.

B. Provide anchor bolts of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

C. Provide post-installed concrete and masonry anchors for anchorage of equipment to concrete or masonry in accordance with Section 05 05 19, Post-Installed Anchors. Provide post-installed anchors of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

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D. Do not use powder-actuated fasteners or sleeve anchors for seismic attachments and anchorage where resistance to tension loads is required. Do not use expansion anchors, other than undercut anchors, for nonvibration isolated mechanical equipment rated over 10 hp.

PART 3 EXECUTION

3.01 GENERAL

A. Make attachments, bracing, and anchorage in such a manner that component lateral force is transferred to lateral force resisting system of structure through a complete load path.

B. Design, provide, and install overall seismic anchorage system to provide restraint in all directions, including vertical, for each component or system so anchored.

C. Provide snubbers in each horizontal direction and vertical restraints for components mounted on vibration isolation systems where required to resist overturning.

D. Provide piping anchorage that maintains design flexibility and expansion capabilities at flexible connections and expansion joints.

1. Piping and ductwork suspended more than 12 inches below supporting structure shall be braced for seismic effects to avoid significant bending of hangers and their attachments.

E. Anchor tall and narrow equipment such as motor control centers and telemetry equipment at base and within 12 inches from top of equipment, unless approved otherwise by Engineer.

F. Do not attach architectural, mechanical, or electrical components to more than one element of a building structure at a single restraint location where such elements may respond differently during a seismic event. Do not make such attachments across building expansion and contraction joints.

3.02 INSTALLATION

A. Do not install components or their anchorages or restraints prior to review and acceptance by Engineer and AHJ.

B. Notify Engineer upon completion of installation of seismic restraints in accordance with Section 01 45 33, Special Inspection, Observation, and Testing.

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3.03 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. In accordance with Section 05 05 19, Post-Installed Anchors.

B. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements, is provided in Section 01 45 33, Special Inspection, Observation, and Testing.

C. Provide any other specified, regulatory required, or required repair verification inspection and testing that is not listed in accordance with Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

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SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DEFINITIONS

A. Facility: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Facility Performance Demonstration:

1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating facility, both manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
2. Such demonstration is for the purposes of (i) verifying to Owner entire facility performs as a whole, and (ii) documenting performance characteristics of completed facility for Owner's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire facility the responsibility of Contractor, unless such performance is otherwise specified.

C. Functional Tests:

1. Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.
2. Provide all functional test as specified herein, and Functional Test Part 1 and Functional Test Part 2, in accordance with Section 40 90 00, Instrumentation and Control for Process Systems.

D. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

E. Unit Process: As used in this section, a unit process is a portion of the facility that performs a specific process function, such as anaerobic digestion, or biosolids dewatering.

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1.02 SUBMITTALS

A. Informational Submittals:

1. Facility Startup and Performance Demonstration Plan.
2. Functional and performance test results.
3. Completed Unit Process Startup Form for each unit process.
4. Completed Facility Performance Demonstration/Certification Form.

1.03 FACILITY STARTUP AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan for review by Engineer and Owner's operations personnel; to include the following:

1. Step-by-step instructions for startup of each unit process and the complete facility.
2. Unit Process Startup Form (sample attached), to minimally include the following:
   a. Description of the unit process, including equipment numbers/nomenclature of each item of equipment and all included devices.
   b. Detailed procedure for startup of the unit process, including valves to be opened/closed, order of equipment startup, etc.
   c. Startup requirements for each unit process, including water, power, chemicals, etc.
   d. Space for evaluation comments.
3. Facility Performance Demonstration/Certification Form (sample attached), to minimally include the following:
   a. Description of unit processes included in the facility startup.
   b. Sequence of unit process startup to achieve facility startup.
   c. Description of computerized operations, if any, included in the facility.
   d. Contractor certification facility is capable of performing its intended function(s), including fully automatic operation.
   e. Signature spaces for Contractor and Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Facility Startup Meetings: Schedule, in accordance with requirements of Section 01 31 19, Project Meetings, to discuss test schedule, test methods,

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materials, chemicals and liquids required, facilities operations interface, and Owner involvement.

B. Contractor's Testing and Startup Representative:

1. Designate and furnish one or more personnel to coordinate and expedite testing and facility startup.
2. Representative(s) shall be present during startup meetings and shall be available at all times during testing and startup.

C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing and startup.

D. Provide Subcontractor and equipment manufacturers' staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing and startup.

E. Owner will:

1. Provide water, power, chemicals, and other items as required for startup, unless otherwise indicated.
2. Operate process units and facility with support of Contractor.
3. Provide labor and materials as required for laboratory analyses.

3.02 EQUIPMENT TESTING

A. Preparation:

1. Complete installation before testing.
2. Furnish qualified manufacturers' representatives, when required by individual specification sections.
3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, in accordance with Section 01 43 33, Manufacturers' Field Services, when required by individual specification sections.
4. Equipment Test Report Form:
    a. Provide written test report for each item of equipment to be tested, to include the minimum information:
        1) Owner/Project Name.
        2) Equipment or item tested.
        3) Date and time of test.
        4) Type of test performed (Functional or Performance).
        5) Test method.
        6) Test conditions.

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7) Test results.
8) Signature spaces for Contractor and Engineer as witness.

5. Cleaning and Checking:
   a. Prior to beginning functional testing:
      1) Calibrate testing equipment in accordance with manufacturer's instructions.
      2) Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
      3) Lubricate equipment in accordance with manufacturer's instructions.
      4) Turn rotating equipment by hand when possible to confirm that equipment is not bound.
      5) Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
      6) Check power supply to electric-powered equipment for correct voltage.
      7) Adjust clearances and torque.
      8) Test piping for leaks.
6. Ready-to-test determination will be by Engineer based at least on the following:
   a. Acceptable Operation and Maintenance Data.
   b. Notification by Contractor of equipment readiness for testing.
   c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
   d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested.
   e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
   f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
   g. Equipment and electrical tagging complete.
   h. Delivery of all spare parts and special tools.

B. Functional Testing:

1. Conduct as specified in individual specification sections.
2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
3. Prepare Equipment Test Report summarizing test method and results.
4. When, in Engineer's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual specification sections. Such acceptance will be evidenced by Engineer/Owner's signature as witness on Equipment Test Report.

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C. Performance Testing:

1. Conduct as specified in individual specification sections.
2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
4. Type of fluid, gas, or solid for testing shall be as specified.
5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
6. Prepare Equipment Test Report summarizing test method and results.
7. When, in Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by Engineer's signature on Equipment Test Report.

3.03 STARTUP OF UNIT PROCESSES

A. Prior to unit process startup, equipment within unit process shall be accepted by Engineer as having met functional and performance testing requirements specified.

B. Startup sequencing of unit processes shall be in the order specified in Section 01 31 13, Project Coordination.

C. Make adjustments, repairs, and corrections necessary to complete unit process startup.

D. Startup shall be considered complete when, in opinion of Engineer, unit process has operated in manner intended for 5 continuous days without significant interruption. This period is in addition to functional or performance test periods specified elsewhere.

E. Significant Interruption:

1. May include any of the following events:
   a. Failure of Contractor to provide and maintain qualified onsite startup personnel as scheduled.
   b. Failure to meet specified functional operation for more than 2 consecutive hours.
   c. Failure of any critical equipment or unit process that is not satisfactorily corrected within 5 hours after failure.

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d. Failure of any noncritical equipment or unit process that is not satisfactorily corrected within 8 hours after failure.
e. As determined by Engineer.

F. A significant interruption will require startup then in progress to be stopped. After corrections are made, startup test period to start from beginning again.

3.04 FACILITY PERFORMANCE DEMONSTRATION

A. When, in the opinion of Engineer, startup of all unit processes has been achieved, sequence each unit process to the point that facility is operational.

B. Demonstrate proper operation of required interfaces within and between individual unit processes.

C. After facility is operating, complete performance testing of equipment and systems not previously tested.

D. Document, as defined in Facility Startup and Performance Demonstration Plan, the performance of the facility including its computer system, until all unit processes are operable and under control of computer system.

E. Certify, on the Facility Performance Demonstration/Certification Form, that facility is capable of performing its intended function(s), including fully automatic and computerized operation.

3.05 SUPPLEMENTS

A. Supplements listed below, following “End of Section,” are a part of this Specification:

1. Unit Process Startup Form.
2. Facility Performance Demonstration/Certification Form.

END OF SECTION

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UNIT PROCESS STARTUP FORM

OWNER: _____ **PROJECT:** _____

Unit Process Description: (Include description and equipment number of all equipment and devices):

_____

_____

_____

_____

Startup Procedure (Describe procedure for sequential startup and evaluation, including valves to be opened/closed, order of equipment startup, etc.):

_____

_____

_____

_____

_____

Startup Requirements (Water, power, chemicals, etc.): _____

_____

_____

Evaluation Comments: _____

_____

_____

_____

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FACILITY PERFORMANCE DEMONSTRATION/CERTIFICATION FORM

OWNER:_____ **PROJECT:**_____

Unit Processes Description (List unit processes involved in facility startup):

_____

_____

_____

_____

Unit Processes Startup Sequence (Describe sequence for startup, including computerized operations, if any):

_____

_____

_____

_____

_____

Contractor Certification that Facility is capable of performing its intended function(s), including fully automatic operation:

Contractor: _____ **Date:** _____**, 20____**

Engineer: _____ **Date:** _____**, 20____**
(Authorized Signature)

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SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI): Guideline K, Containers for Recovered Non-flammable Fluorocarbon Refrigerants.
2. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.
3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:
   a. Part 61—National Emission Standards for Hazardous Air Pollutants.
   b. Part 82—Protection of Stratospheric Ozone.
   c. Part 273—Standards for Universal Waste Management.
4. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926—Occupational Safety and Health Regulations for Construction.

1.02 DEFINITIONS

A. ACM: Asbestos-containing material.

B. Demolition: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof. Demolition also includes removal of pipes, manholes tanks, conduit, and other underground facilities, whether as a separate activity or in conjunction with construction of new facilities.

C. Modify: Provide all necessary material and labor to modify an existing item to the condition indicated or specified.

D. Relocate: Remove, protect, clean and reinstall equipment, including electrical, instrumentation, and all ancillary components required to make the equipment fully functional, to the new location identified on Drawings.

E. Renovation: Altering a facility or one or more facility components in any way.

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F. Salvage/Salvageable: Remove and deliver, to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of Owner. Unless otherwise specified, title to items identified for demolition shall revert to Contractor.

G. Universal Waste Lamp: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

H. Universal Waste Thermostat: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.03 SUBMITTALS

A. Informational Submittals:

1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
2. Submit copies of any notifications, authorizations and permits required to perform the Work.
3. Submit a shipping receipt or bill of lading for all containers of ozone depleting substance (ODS) shipped.
4. Submit a shipping receipt or bill of lading for all containers of ACM shipped.
5. Submit a shipping receipt or bill of lading for all universal waste shipped.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General Conditions, Contractor’s safety requirements shall conform to ANSI A10.6.

C. Furnish timely notification of this renovation project to applicable federal, state, regional, and local authorities in accordance with 40 CFR 61-Subpart M.

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1.05 DEMOLITION/RENOVATION PLAN

A. Demolition/Renovation Plan shall provide for safe conduct of the Work and shall include:

1. Detailed description of methods and equipment to be used for each operation.
2. The Contractor's planned sequence of operations, including coordination with other work in progress.
3. Procedures for removal and disposition of materials specified to be salvaged.
4. Disconnection schedule of utility services.

B. Include statements affirming Contractor inspection of the existing roof deck, floors, walls, and framing members, and their suitability to perform as a safe working platform or, if inspection reveals a safety hazard to workers, state provisions for securing the safety of the workers throughout the performance of the Work.

1.06 SEQUENCING AND SCHEDULING

A. The Work of this Specification shall not commence until Contractor's Demolition/Renovation Plan has been approved by Engineer.

B. Include the Work of this Specification in the progress schedule, as specified in Section 01 32 00, Construction Progress Documentation.

C. Areas in which the Work is to be accomplished will be available in accordance with Section 01 31 13, Project Coordination.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. Facilities: Portions of buildings and other areas scheduled for selective demolition, partial demolition, and renovation Work are as shown.

B. Structures: As shown.

C. Utilities and Related Equipment:

1. Notify Owner or appropriate utilities to turn off affected services at least 48 hours before starting demolition or renovation activities.

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2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Engineer.
3. When utility lines are encountered that are not indicated on Drawings, notify Owner prior to further work in that area.
4. Remove meters and related equipment and deliver to a location as determined by the Owner.

D. Paving and Slabs:

1. Sawcut concrete and asphaltic concrete paving and remove by excavating individual pieces of 6 inches of diameter or less.
2. Provide neat sawcuts at limits of pavement removal as indicated.

E. Masonry: Sawcut and remove masonry so as to prevent damage to surfaces to remain and to facilitate the installation of new Work. Where new masonry adjoins existing, the new Work shall abut or tie into the existing construction as indicated and as specified.

F. Concrete:

1. Core drill corners of new opening to avoid overcutting adjacent reinforcing in existing concrete to remain. Saw concrete along straight lines to a depth of not less than 2 inches. Make each cut in walls perpendicular to the face and in alignment with the cut in the opposite face. Break out the remainder of the concrete provided that the broken area is concealed in the finished Work, and the remaining concrete is sound.
2. At locations where the broken face cannot be concealed, grind smooth or saw cut entirely through the concrete. Repair exposed rebar ends and embeds as shown on Drawings.
3. Where new concrete adjoins existing concrete, thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 3/16 inch. Rebar and small embeds at existing concrete may be required to be left to engage new concrete. Saturate surface with water for 24 hours prior to placing new concrete. The new Work shall tie into the existing construction as shown on Drawings.
4. At submerged locations not to receive new concrete, paint exposed rebar or metal embed ends with System No. 19a at wastewater surfaces per Section 09 90 00, Painting and Coating.

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G. Patching:

1. Where removals leave holes and damaged surfaces exposed in the finished Work, patch, and repair to match adjacent finished surfaces as to texture and finish.
2. Where new Work is to be applied to existing surfaces, perform removals and patching in a manner to produce surfaces suitable for receiving new Work.
3. Patching shall be as specified and indicated, and shall include: Fill holes and depressions caused by previous physical damage or left as a result of removals in existing concrete walls with an approved patching material, applied in accordance with the manufacturer's printed instructions.

H. Cylinders and Canisters: Remove all fire suppression system cylinders and canisters and dispose as specified in Paragraph Ozone Depleting Substances (ODS).

I. Door Locksets: Remove all locksets from all doors indicated to be removed and disposed of. Turn locksets over to Owner immediately after their removal.

J. Electrical:

1. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 3/4 inch below final finished surface.
2. When removing designated equipment, conduit and wiring may require rework to maintain service to other equipment.
3. Rework existing circuits, or provide temporary circuits as necessary during renovation to maintain service to existing lighting and equipment not scheduled to be renovated. Existing equipment and circuiting shown are based upon limited field surveys. Verify existing conditions, make all necessary adjustments, and record the Work on Record Drawings. This shall include, but is not limited to, swapping and other adjustments to branch circuits and relocation of branch circuit breakers within panelboards as required to accomplish the finished work.
4. Reuse of existing luminaires, devices, conduits, boxes, or equipment will be permitted only where specifically indicated.
5. Raceways and cabling not scheduled for reuse.
    a. Demolish conductors back to source.
    b. Demolish exposed conduit back to source or first junction box where existing conductors share conduit.
    c. Provide cover plate or cap over raceway opening exposed from demolition work.
6. Inaccessibly Concealed: Cut off and abandon in place.

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7. Exposed or Concealed Above Accessible Ceilings: Remove.
8. Raceways and Cabling Scheduled for Future Use: Cap/seal and tag.
9. Relocating Equipment: Extend existing wiring or run new wiring from the source.
10. Where the existing raceway is concealed, the outlet box shall be cleaned, and a blank cover plate installed.
11. Where the concealed raceway is uncovered remove raceway (or extended to new location if appropriate).
12. Provide new typewritten panelboard circuit directory cards.

K. Universal Waste Lamps and Thermostats: Manage, contain, package, and label in strict accordance with 40 CFR 273.

3.02 PROTECTION

A. Building Occupancy: Refer to Section 01 31 13, Project Coordination, for specific requirements related to concurrent occupancy of facilities to be partially demolished.

B. Dust and Debris Control:

1. Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.
2. Vacuum and dust the Work area daily.
3. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

C. Traffic Control Signs: Where pedestrian and driver safety is endangered in the area of removal Work, use traffic barricades with flashing lights.

D. Existing Work:

1. Survey the site and examine the Drawings and Specifications to determine the extent of the Work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of Owner; any Contractor-damaged items shall be repaired or replaced as directed by Engineer.

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3. Provide temporary weather protection during interval between removal of existing exterior surfaces and installation of new to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
4. Ensure that structural elements are not overloaded as a result of or during performance of the Work. Responsibility for additional structural elements or increasing the strength of existing structural elements as may be required as a result of any Work performed under this Contract shall be that of the Contractor. Repairs, reinforcement, or structural replacement must have Engineer approval.
5. Do not overload pavements to remain.

E. Weather Protection: For portions of the building scheduled to remain, protect building interior and materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the Work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent loss.

F. Trees: Protect trees within the Site that might be damaged during demolition and are indicated to be left in place, by a 6-foot-high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the Work shall be replaced in kind, as approved by the Engineer.

G. Facilities:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring, and are determined by Contractor to be in stable condition, shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Engineer.
3. Protect all facility elements not scheduled for demolition.
4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.

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H. Protection of Personnel:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
2. Provide temporary barricades and other forms of protection to protect Owner's personnel and the general public from injury due to demolition Work.
3. Provide protective measures as required to provide free and safe passage of Owner's personnel and the general public to occupied portions of the structure.

3.03 BURNING

A. The use of burning at the Site for the disposal of refuse and debris will not be permitted.

3.04 RELOCATIONS

A. Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Clean all items to be relocated prior to reinstallation, to the satisfaction of Engineer. Repair items to be relocated which are damaged or replace damaged items with new undamaged items as approved by Engineer.

3.05 TITLE TO MATERIALS

A. All salvaged equipment and materials designated to be removed shall become the property of Contractor:

B. Title to equipment and materials resulting from demolition and renovation is vested in the Contractor upon approval by Engineer of Contractor's Demolition/Renovation Plan, and the resulting authorization by Engineer to begin demolition or renovation.

3.06 DISPOSITION OF MATERIAL

A. Do not remove equipment and materials without approval of Contractor's Demolition/Renovation Plan by Engineer.

B. Salvage equipment and material to the maximum extent possible.

C. Owner will not be responsible for the condition or loss of, or damage to, such property after Engineer's authorization to begin demolition or renovation.

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D. Store salvaged items as approved by Engineer and remove them from Owner's property before completion of the Contract. Materials and equipment shall not be either viewed by prospective purchasers or sold on the Site.

3.07 REUSE OF MATERIALS AND EQUIPMENT

A. Remove and store materials and equipment listed in Article Title To Materials to be reused or relocated to prevent damage, and reinstall as the Work progresses.

B. Properly store and maintain equipment and materials in same condition as when removed.

C. Store equipment and material designated to be reused in a location designated by Owner.

D. Equipment and material designated to be reused shall be cleaned, serviced, and checked for proper operability before being put back into service.

E. Engineer will determine condition of equipment and materials prior to removal.

3.08 SPECIALIZED SALVAGE

A. Ozone Depleting Substances (ODS):

1. Class I and Class II ODS are defined in Section 602(a) and (b), of The Clean Air Act. Prevent discharge of Class I and Class II ODS to the atmosphere. Place recovered ODS in cylinders meeting AHRI Guideline K suitable for the type ODS (filled to no more than 80 percent capacity) and provide appropriate labeling.
2. Dispose of all Class I and Class II ODS refrigerants in accordance with the Clean Air Act Amendment of 1990.
3. Products, equipment, and appliances containing ODS in a sealed, self-contained system (such as: residential refrigerators and window air conditioners) shall be disposed of in accordance with 40 CFR 82.

3.09 UNSALVAGEABLE MATERIAL

A. Concrete, masonry, and other noncombustible material, except concrete permitted to remain in place, shall be disposed of in accordance with federal, state, and local laws at permitted disposal facilities.

B. Universal Waste Lamps and Thermostats: Dispose of in strict accordance with 40 CFR 273.

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3.10 CLEANUP

A. Debris and rubbish shall be removed from basement and similar excavations. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION

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SECTION 03 01 32
REPAIR OF VERTICAL AND OVERHEAD CONCRETE SURFACES

PART 1 GENERAL

1.01 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. High-Pressure Water Blasting: Sometimes referred to as hydro-demolition. Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

C. Low-Pressure Spray Mortar: Mortar suitable to be applied by low-pressure spraying, and in small areas may be applied by hand troweling.

D. Scabbler: Pneumatically operated tool designed to roughen or remove a concrete surface using carbide tipped pins capable of removing approximately 1/4-inch depth of concrete per pass.

1.02 SUBMITTALS

A. Action Submittals: Product data sheets for each material supplied.

B. Informational Submittals:

1. Repair Mortar System: Manufacturer’s preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.
3. Statements of Qualification: Repair mortar system applicator.
4. Field and laboratory test reports.

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1.03 QUALITY ASSURANCE

A. Qualifications:

1. Repair Mortar System Applicator: For Repair System B – Low-Pressure Spray Mortar, in lieu of recognition or certification, demonstrate application of repair mortar manufacturer's system and obtain Certification of Proper Installation.

B. Pre-repair Conference:

1. Required Meeting Attendees:
   a. Contractor.
   b. Repair Subcontractor.
   c. Engineer.
2. Agenda shall include, but not limited to:
   a. Review of field conditions. Conduct field observations of Work to be performed.
   b. Based on above observations, confirm material selection and make Project-specific repair method recommendations.
   c. Review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
   d. Other specified requirements requiring coordination.

C. Mockups:

1. Required for concrete surface removal, preparation, and repair mortar systems over 1,000 square feet in area.
2. Before proceeding with Work under this section, finish one complete space or item of each repair mortar system showing colors, finish texture, materials, quality of work, and applicable special details.
3. Provide one mockup for each repair mortar system.
4. Mockup components will vary, depending on the repair mortar system. All components of the repair mortar system, including surface preparation, must be exposed in the mockup.
5. Mockup Procedure:
   a. Prepare surface and apply repair mortar to one section of concrete, 100 square feet, at a location mutually agreed upon by the Contractor and Engineer. Use a "step" down mockup as follows:
      1) Perform surface preparation using approved methods to demonstrate uniform removal to specified depth based on pH testing without exceeding the approved depth of removal.

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2) Upon approval of surface preparation and depth of concrete removal, continue with mortar repair systems.
3) Leave one-half of the surface exposed to allow observation of the surface preparation.
4) Apply repair mortar to one-half of the remaining surface.

6. After Engineer and Manufacturer review and approval, sample spaces or items shall serve as a standard for similar work throughout the Project.
7. Leave mockup in place to serve as a reference and standard for the remaining work.
8. At completion of Project, clean and prepare all surfaces that are not complete and finish applying repair mortar to the mockup area for incorporation into the Work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

1.05 MEASUREMENT AND PAYMENT

A. Measurement for vertical and overhead concrete surface removal and repair pay items shall be determined per the following procedure:

1. Prior to removal of existing concrete, install 1/4-inch diameter Type 316, stainless steel rods into face of existing walls (at right angle to wall) in a vertical row at 25 feet on center horizontally. Each vertical row shall consist of three anchor rods equally spaced. The rods shall be located 12 inches below top of wall, mid-height of the wall, and 12 inches above bottom of wall. Drill and epoxy these stainless steel rods a minimum of 3 inches into the existing wall.
2. After installation of steel rods, cut rods flush with the face of existing concrete. Rods will subsequently be used for measurement purposes. Contractor shall prepare for Engineer's approval (prior to rod placement) a rod layout grid with grid naming convention to allow uniform reference to each area of concrete repair. All measurement and payment shall follow this rod layout and naming convention.
3. Remove existing concrete as indicated herein.
4. Following removal of existing concrete, install additional, new 1/4-inch diameter x minimum 6-inch-long Type 316 stainless steel rods 12 inches away from and adjacent to all existing rods. Cover rod ends with rubber bulb to reduce risk of accidental injury after installed. Drill

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and epoxy new rods a minimum of 3 inches beyond face of demolished concrete. String a steel piano wire between the new rods at the depth of the original existing concrete surface (i.e. with piano wire just touching end of rods placed flush with original concrete surface) and to meet the tolerances listed herein.

5. Screed final product as indicated to original existing concrete surface profile unless a maximum of 1/2 inch of additional build out is required to provide a minimum of 2 inches of clearance over exposed reinforcing.
6. Payment for removal will be based upon measured thickness of removed concrete at rods. The thickness will be determined by averaging the measured depth of removal over each 100 square foot area to determine total quantities for each pay item.
7. Payment for installation of repair will be based upon the measured thickness determined for removal of each 100 square foot area plus any anticipated build out (to provide clearance over exposed reinforcing as described in this section). The thickness will be determined by averaging the measured depth of application over each 100 square foot area to determine total quantity for payment.
8. Contractor may submit alternate methods of measurement subject to Owner and Engineer's approval.
9. Pay Items and Unit of Measurement:
    a. Vertical Concrete Surface Removal and Repair; Square Foot:
        1) 0 Inch to 1/2 Inch Removal Depth and Repair Layer Thickness: Lump Sum.
        2) 5/8 Inch to 1 Inch Removal Depth and Repair Layer Thickness: Unit Price.
        3) Greater than 1 Inch to 1-1/2 Inches Removal Depth and Repair Layer Thickness: Unit Price.
    b. Overhead Concrete Surface Removal and Repair; Square Foot:
        1) 0 Inch to 1/2 Inch Removal Depth and Repair Layer Thickness: Lump Sum.
        2) 5/8 Inch to 1 Inch Removal Depth and Repair Layer Thickness: Unit Price.
        3) Greater than 1 inch to 1-1/2 inches removal depth and repair layer thickness.

PART 2 PRODUCTS

2.01 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR

A. One-component or two-component, cement based, fiber reinforced, shrinkage compensated, gray in color, with a minimum 30-minute working time.

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B. Cured materials mixed in accordance with manufacturer's instructions shall conform to the following criteria:

1. Compressive Strength, ASTM C109/C109M at 28 Days: 6,000 psi minimum.
2. Flexural Strength, ASTM C348 at 28 Days: 1,100 psi minimum.
3. Slant Shear Bond Strength, ASTM C882/C882M Test Method Modified with No Bonding Agent, at 28 Days: 3,000 psi minimum.
4. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.
5. Drying Shrinkage, ASTM C157/C157M Modified at 28 Days or ASTM C531: 0.1 percent maximum.
6. Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 1,000 coulombs maximum.
7. System shall not produce a vapor barrier.
8. Sprayable, extremely low permeability, sulfate resistant, easy to use and requiring only addition of water.
9. Free of chlorides and other chemicals causing corrosion.

C. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 488CI.
2. Sika Corp., Lyndhurst, NJ; SikaRepair 226CI.
3. Euclid Chemical Co., Cleveland, OH; Tamms Structural Mortar.

2.02 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

PART 3 EXECUTION

3.01 PREPARATION

A. Remove unsound, honeycombed, deteriorated, or otherwise defective areas of concrete from work areas.

1. Use scabbler, abrasive blasting, or high-pressure water blasting as required to achieve concrete removal.
    a. If high-pressure water blasting is used operating pressure shall not exceed 15,000 psi to reduce risk of concrete removal depth greater than approved. Concrete removal shall be closely monitored to avoid excess concrete removal depth, and maximum pressure shall be reduced if excess depth of removal is encountered.

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2. Abrade substrate concrete surfaces to provide a Concrete Surface Profile (CSP); eight per the International Concrete Repair Institute (ICRI).
3. For existing structures, extent of concrete removal as shown on Drawings and described herein.
4. Remove existing concrete depth a minimum of 1/2 inch, not to exceed a tolerance of 1/8 inch deeper.
5. Measure pH every 100 square feet to determine if a pH 11 or above is achieved.
6. Where pH is less than 11, perform exploratory concrete removal and perform additional pH tests to identify areas and depths of concrete removal required to achieve a concrete surface with pH 11.
7. Remove concrete in areas identified in exploratory testing by determined depths, not to exceed a maximum existing concrete depth of 1-1/2 inches. If the maximum depth of removal is achieved and the concrete still measures a pH below 11, consult the Engineer. Depth of concrete removal shall not exceed 1-1/2 inches, without approval from Engineer.
8. Cost for concrete removal, disposal of waste streams and debris, and repair mortar system for concrete removal greater than approved depths, as demonstrated by pH testing at each depth increment, shall be borne by the Contractor.
9. Where existing reinforcing is encountered, clean and coat reinforcing with corrosion inhibitor compatible with repair material, as recommended by manufacturer of repair material and approved by Engineer.
10. Where final surface is required to be flush with existing adjacent surface, remove existing concrete depth as required for application of minimum thickness of repair mortar.

B. Do not use power-driven jackhammers or chipping hammers unless water blasting or abrasive blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities.

C. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of scabbler.

D. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge with high-pressure water blasting or abrasive hand operated power tools.

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E. Keep areas from which concrete has been removed free of dirt, dust, high-pressure water blasting waste slurry, and other contaminants. Remove laitance and other bond inhibiting contaminates from prepared areas.

F. Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar as required by and in accordance with repair mortar manufacturer's printed instructions.

G. Collect and dispose of spent water, overshot repair material, and concrete debris from repair operations offsite in manner and location acceptable to Owner.

3.02 PROTECTION

A. Protect adjacent surfaces, and equipment, from being damaged by overshooting, rebound, and dust, as applicable for repair mortar system used, from low-pressure spray mortar.

3.03 REPAIR SYSTEM B – LOW-PRESSURE SPRAY MORTAR PLACEMENT

A. Mix mortar in accordance with manufacturer's printed instructions.

B. After priming prepared substrate concrete surface per manufacturer's recommendations, apply mortar by low-pressure spraying equipment, unless noted otherwise.

C. Bonding Agent:

1. Use bonding agent when manufacture required for hand applied areas, in accordance with repair mortar manufacturer's instructions.
2. Application of repair mortar over bonding agent shall be completed within time frame recommended by bonding agent manufacturer.
3. Consult with manufacturer for optimum and minimum acceptable degrees of surface tackiness of coat.

D. Work mortar firmly and quickly into repair area.

E. Finish repair mortar to a smooth, steel-troweled finish as demonstrated on the mock-up panel. Final finished interior basin dimensions shall match original design drawings to a dimension of plus or minus 1/2 inch or a tolerance as required by the treatment equipment manufacturer.

F. Cure as specified in Article Curing.

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3.04 CURING

A. Prior to curing, apply water fog to repair mortar system in accordance with repair mortar system manufacturer's printed instructions.

B. Cure in accordance with repair mortar manufacturer's printed instructions.

C. Where permitted by repair mortar manufacturer's printed instructions, commence water curing after repair mortar system application and when curing will not cause erosion of mortar.

D. Continuously water cure repair mortar system for a period of 7 days.

E. Do not cure using curing compound or membrane, unless method is part of repair mortar system manufacturer's printed instructions and approval is obtained from Engineer.

F. Cure intermediate layers of repair mortar in accordance with repair mortar manufacturer's printed instructions.

G. Where curing compound is permitted by repair mortar system manufacturer, apply curing compound.

3.05 FIELD QUALITY CONTROL

A. Concrete pH Testing:

1. Test pH every 100 square feet.
2. Test pH of existing concrete per pH test material manufacturer's recommendations.
    a. Clean exposed surface with distilled water.
    b. Check pH with approved testing material.
    c. Record data.
3. pH Test Material:
    a. Hydrion Insta-chek 0-13 Mechanical pH Pencil.
    b. "Or-equal."

B. Sounding for Hollow Areas:

1. Light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
2. Mark hollow areas for removal and replacement.

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C. Direct Tension Bond Test:

1. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
2. Perform test for every 1,000 square feet of mortar repair, and a minimum of 3 test total.
3. Record locations on in situ bond tests on each type of applied repair mortar.

D. Testing laboratory retained by Contractor will provide the following:

1. Compression Strength Test:
   a. Testing will follow a “modified” ASTM C109/C109M.
   b. A minimum of three production samples of mixed material will be obtained from each 1,000 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing at 7 days, and 28 days.
   c. Record location where repair mortar is being applied at time production samples are obtained.

E. Retest mortar repairs that do not meet test requirements.

F. Repair and fill holes using same repair mortar where core samples have been removed.

3.06 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge. Remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

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3.07 CLEANING

A. Remove overshot low-pressure spray, Repair System B repair mortar and rebound materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of or repair areas, finishing, and curing, and dispose offsite at an approved disposal site as specified in Section 01 50 00, Temporary Facilities and Controls.

END OF SECTION

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SECTION 03 01 33
REPAIR OF HORIZONTAL CONCRETE SURFACES

PART 1 GENERAL

1.01 DEFINITIONS

A. Abrasive Blasting: Surface preparation method that uses compressed air intermixed with an abrasive medium to clean surface of substrate concrete, exposed steel, and steel reinforcement. Compressed air and abrasive medium is projected at high speed through a nozzle directly at the surface. Method is used to remove corrosion by-products, laitance, or other materials that may inhibit bond of repair concrete.

B. High-Pressure Water Blasting (sometimes referred to as hydro-demolition): Uses water that may contain an abrasive medium, projected under high pressure and high velocity. Used for demolition, cutting, partial or full depth removal, cleaning, scarifying, or roughening of concrete surfaces, or removing existing coatings, for preparation of substrate concrete surfaces.

C. Scabbler: Pneumatically operated tool designed to roughen or remove a concrete surface using carbide tipped pins capable of removing approximately 1/4-inch depth of concrete per pass.

1.02 SUBMITTALS

A. Action Submittals: Product data sheets for each material supplied.

B. Informational Submittals:

1. Repair Mortar System: Manufacturer’s preparation and installation instructions.
2. Written description of equipment proposed for concrete removal and surface preparation.
3. Statements of Qualification: Repair mortar system applicator.
4. Field and laboratory test results.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Repair Mortar System Applicator: Trained and experienced applicator endorsed by repair mortar system manufacturer.

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B. Pre-repair Conference:

1. Required Meeting Attendees:
   a. Contractor.
   b. Repair Subcontractor.
   c. Engineer.
2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include, but not limited to:
   a. Review of field conditions. Conduct field observations of the Work to be performed.
   b. Based on above observations, confirm material selection and make Project specific repair method recommendations.
   c. Review proposed surface preparation, material application, consolidation, finishing, curing, and protection of repair material from weather conditions.
   d. Other specified requirements requiring coordination.

C. Mockups:

1. Required for concrete surface removal, preparation, and repair mortar systems over 1,000 square feet in area.
2. Before proceeding with Work under this section, finish one complete space or item of each repair mortar system showing colors, finish texture, materials, quality of work, and applicable special details.
3. Provide one mockup for each repair mortar system.
4. Mockup components will vary, depending on the repair mortar system. All components of the repair mortar system, including surface preparation, must be exposed in the mockup.
5. Mockup Procedure:
   a. Prepare and apply repair mortar to one section of concrete, 100 square feet, at a location mutually agreed upon by the Contractor and Engineer. Use a “step” down mockup as follows:
      1) Perform surface preparation using approved methods to demonstrate uniform removal to specified depth based on pH testing without exceeding the approved depth of removal.
      2) Upon approval of surface preparation and depth of concrete removal, continue with mortar repair systems.
      3) Leave one-half of the surface exposed to allow observation of the surface preparation.
      4) Apply repair mortar to one-half of the remaining surface.
6. After Engineer and Manufacturer review and approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

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7. Leave mockup in place to serve as a reference and standard for the remaining work.
8. At completion of Project, clean and prepare all surfaces that are not complete and finish applying repair mortar to the mockup area for incorporation into the Work.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package repair mortar system products in moisture-resistant bags, pails, or moisture-resistant bulk bags.

B. Deliver, store, and handle repair materials in accordance with manufacturer's printed instructions.

1.01 MEASUREMENT AND PAYMENT

A. Measurement for horizontal concrete surface removal and repair pay items shall be determined per the following procedure:

1. Prior to removal of existing concrete, install 1/4-inch diameter Type 316, stainless steel rods into top of existing slab (at right angle to wall) at 25 feet on center horizontally and a minimum of 3 per width of channel. The outer rods shall be located 12 inches from face of wall, and the middle rod shall be centered on the slab. Drill and epoxy these stainless steel rods a minimum of 3 inches into the existing slab.
2. After installation of steel rods, cut rods flush with the face of existing concrete. Rods will subsequently be used for measurement purposes. Contractor shall prepare for Engineer's approval (prior to rod placement) a rod layout grid with grid naming convention to allow uniform reference to each area of concrete repair. All measurement and payment shall follow this rod layout and naming convention.
3. Remove existing concrete as indicated herein.
4. Following removal of existing concrete, install additional, new 1/4-inch diameter x minimum 6 inches long Type 316 stainless steel rods 12 inches away from and adjacent to all existing rods. Cover rod ends with rubber bulb to reduce risk of accidental injury after installed. Drill and epoxy new rods a minimum of 3 inches beyond face of demolished concrete. String a steel piano wire between the new rods at the depth of the original existing concrete surface (i.e. with piano wire just touching end of rods placed flush with original concrete surface) and to meet the equipment tolerances listed herein.

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5. Screed final product as indicated to original existing concrete surface profile unless a maximum of 1/2 inch of additional build out is required for equipment installation or to provide a minimum of 2 inches of clearance over exposed reinforcing.
6. Payment for removal will be based upon measured thickness of removed concrete at rods. The thickness will be determined by averaging the measured depth of removal over a 100 square foot area to determine total quantity for payment.
7. Payment for installation of repair will be based upon the measured thickness determined for removal of each 100 square foot area plus any anticipated build out. The thickness will be determined by averaging the measured depth of application over each 100 square foot area to determine total quantity for payment.
8. Contractor may submit alternate methods of measurement subject to Owner and Engineer's approval.
9. Pay Items and Unit of Measurement:
    a. Horizontal Concrete Surface Removal and Repair; Square Foot:
        1) 0 Inch to 1/2 Inch Removal Depth and Repair Layer Thickness: Lump Sum.
        2) 5/8 Inch to 1 Inch Removal Depth and Repair Layer Thickness: Unit Price.
        3) Greater than 1 Inch to 1-1/2 Inches Removal Depth and Repair Layer Thickness: Unit Price.

PART 2 PRODUCTS

2.01 REPAIR MORTAR SYSTEM NO. 3—SHRINKAGE COMPENSATED REPAIR MORTAR

A. One or two-component cement-based, flowable, shrinkage compensated repair mortar system.

B. Compressive Strength, ASTM C109/C109M:

1. 1 Day: 2,500 psi minimum.
2. 7 Days: 6,000 psi minimum.
3. 28 Days: 8,000 psi minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 770 psi minimum.

D. Modulus of Elasticity, ASTM C469 at 28 Days: 5.9 by 10^6 psi minimum.

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E. Slant Shear Bond Strength, ASTM C882/C882M Modified:

1. 7 Days: 2,150 psi minimum.
2. 28 Days: 3, 000 psi minimum.

F. Freeze-thaw Resistance, ASTM C666/C666M, Procedure A, at 300 Cycles: 97.0 percent RDM.

G. Chloride Ion Permeability Based on Charge Passed, ASTM C1202 at 28 Days: 650 coulombs maximum.

H. Sulfate Resistance, ASTM C1012/C1012M after 6 Months: 0.01 percent length change maximum.

I. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco S 466 CI.
2. Euclid Chemical Co., Cleveland, OH; Eucocrete Supreme.

2.02 REPAIR MORTAR SYSTEM NO. 5—POLYMER MODIFIED REPAIR MORTAR

A. One-component or two-component, fast-setting, polymer modified cementitious based repair mortar system.

B. Compressive Strength, ASTM C109/C109M:

1. 1 Day: 2,500 psi minimum.
2. 7 Days: 5,000 psi minimum.
3. 28 Days: 7,000 psi minimum.

C. Flexural Strength, ASTM C348 at 28 Days: 1,500 psi minimum.

D. Slant Shear Bond Strength, ASTM C882/C882M Modified at 28 Days: 2,000 psi minimum.

E. Splitting Tensile Strength, ASTM C496/C496M at 28 Days: 600 psi minimum.

F. Abrasion Resistance Depth of Wear, ASTM C779/C779M, Procedure A, at 60 Minutes: 0.033 inch maximum.

G. Drying Shrinkage, ASTM C157/C157M Modified, at 28 Days: 0.09 percent maximum.

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H. Rapid Chloride Ion Permeability Based on Charge Passed, ASTM C1202: 28 Days: Under 850 coulombs maximum.

I. Manufacturers and Products:

1. BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco T 310 CI.
2. Euclid Chemical Co., Cleveland, OH; Duraltop Flowable Mortar.
3. Sika Corp., Lyndhurst, NJ; SikaTop 111 PLUS.

2.03 WATER

A. Clean and free from oil, acid, alkali, organic matter, or other deleterious substances, meeting federal drinking water standards.

2.04 EPOXY BONDING AGENT

A. Two-component, moisture insensitive, 100 percent solids epoxy resin.

B. Tensile Strength, ASTM D638, at 14 Days: 4,400 psi minimum.

C. Elongation at Break, ASTM D638: 1.49 percent minimum.

D. Compressive Strength, ASTM D695, at 28 Days for Application Temperature of 73 Degrees F to 77 Degrees F: 8,000 psi minimum.

E. Bond Strength, ASTM C882/C882M, at 14 Days: 1,800 psi minimum.

F. Pot Life, at 73 Degrees F to 77 Degrees F: 75 minutes minimum.

G. Manufacturers and Products: BASF Construction Chemicals, LLC - Building Systems, Shakopee, MN; MasterEmaco ADH 326 when ambient temperature is 73 degrees F or higher.

PART 3 EXECUTION

3.01 PREPARATION

A. Identify unsound and deteriorated concrete by sounding techniques, or as directed by Engineer. Review proposed extent of repair with Engineer.

B. Remove unsound, deteriorated, or otherwise defective areas of concrete from Work areas.

1. Use scabbler, abrasive blasting, or high-pressure water blasting as required to achieve concrete removal. If high-pressure water blasting is

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used operating pressure shall not exceed 15,000 psi to reduce risk of concrete removal depth greater than approved. Concrete removal shall be closely monitored to avoid excess concrete removal depth, and maximum pressure shall be reduced if excess depth of removal is encountered.

2. Abrade substrate concrete surfaces to provide a Concrete Surface Profile (CSP); eight per the International Concrete Repair Institute (ICRI).
3. For existing structures, extent of concrete removal as shown on Drawings.
4. Remove existing concrete depth a minimum of 1/2 inch, not to exceed a tolerance of 1/8 inch deeper.
5. Measure pH every 100 square feet to determine if a pH 11 or above is achieved.
6. Where pH is less than 11, perform exploratory concrete removal and perform additional pH tests to identify areas and depths of concrete removal required to achieve a concrete surface with pH 11.
7. Remove concrete in areas identified in exploratory testing by determined depths, not to exceed a maximum existing concrete depth of 1-1/2 inches. If the maximum depth of removal is achieved and the concrete still measures a pH below 11, consult the Engineer. Depth of concrete removal shall not exceed 1-1/2 inches, without approval from Engineer.
8. Cost for concrete removal, disposal of waste streams and debris, and repair mortar system for concrete removal greater than approved depths, as demonstrated by pH testing at each depth increment, shall be borne by the Contractor.
9. Where existing reinforcing is encountered, clean and coat reinforcing with corrosion inhibitor compatible with repair material, as recommended by manufacturer of repair material and approved by Engineer.
10. Where final surface is required to be flush with existing adjacent surface, remove existing concrete depth as required for application of minimum thickness of repair mortar.

C. Do not use power-driven jackhammers or chipping hammers unless water blasting is not permitted or practical because of Site conditions, or may cause other damage to equipment or facilities.

D. Following removal of unsound or deteriorated concrete, check substrate concrete surface by sounding techniques to identify unsound concrete remaining or resulting from use of scabbler.

E. Remove unsound concrete to satisfaction of Engineer.

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F. Square edges of patch areas by sawing or chipping to avoid tapered shoulders or featheredges. Avoid cutting embedded steel reinforcement. Roughen polished saw-cut edge with high-pressure water blasting or abrasive hand operated power tools.

G. Keep areas from which concrete has been removed free of dirt, dust, high-pressure water blasting slurry, and other contaminants. Remove laitance and other bond inhibiting contaminates from prepared areas.

H. Preparation of Substrate Concrete Surface in Areas to Receive Repair Mortar System No. 3, and No. 5: Dampen repair areas at least 6 inches beyond area to receive repair mortar for at least 24 hours to provide saturated surface dry (SSD) condition without standing water at time of application of mortar, as required by and in accordance with repair mortar manufacturer's printed instructions.

I. Spalled Joints:

1. Saw cut edge 1 inch deep and 6 inches back from old joint.
2. Remove unsound concrete and concrete between saw cut and joint.
3. Place wood or fiber spacer to thickness of joint at joint line.

J. Overlays:

1. Square cut edges to a minimum of 1/4 inch deep.
2. Do not feather edge area.
3. Perform special preparation recommended by mortar manufacturer.

K. Collect and dispose of spent water and concrete debris from removal operations offsite in manner and location acceptable to Owner.

3.02 PROTECTION

A. If cementitious coating or bonding agent is used, protect adjacent surfaces from over application. Promptly remove bonding agent applied beyond repair area.

B. Protect adjacent surfaces, and equipment from spillage of repair mortar and dust, as applicable for repair mortar system used.

3.03 PLACEMENT

A. Repair Mortar System No. 3 and No. 5:

1. Remove standing and free water from prepared area.

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2. Apply bond scrub coat of mortar to prepared surface in accordance with manufacturer's instructions. Do not apply more scrub coat of mortar than can be covered with repair mortar before scrub coat begins drying.
3. Immediately place mixed repair mortar into prepared area from one side to the other side.
4. Work material firmly into bottom and sides of patch to ensure a good continuous bond.
5. Level repair mortar and screed to elevation of existing concrete.
6. Finish to same texture as existing concrete around patch.
7. Repair Mortar System No. 5 screed or use self-leveling mixture to obtain a uniform and plane surface.

B. Joint Repair:

1. Remove joint spacer when repair mortar is hard enough that a pointed trowel will penetrate surface less than 1/2 inch.
2. When repair mortar is cured and ready for use, fill joint in accordance with repair mortar system manufacturer's instructions.

3.04 FINISHING

A. Spray full strength evaporation retardant on fresh concrete to prevent rapid drying during hot and windy weather.

3.05 CURING

A. Repair Mortar System No. 3 or No. 5: Apply curing compound in accordance with Manufacturer's instructions.

3.06 FIELD QUALITY CONTROL

A. Concrete pH Testing:

1. Test pH every 100 square feet at each removal depth.
2. Test pH of existing concrete per pH test material manufacturer's recommendations.
   a. Clean exposed surface with distilled water.
   b. Check pH with approved testing material.
   c. Record data.
3. pH Test Material:
   a. Hydrion Insta-chek 0-13 Mechanical pH Pencil.
   b. "Or-equal."

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B. Sounding for Hollow Areas:

1. Chain drag or light hammer tap repaired areas listening for hollow sound to determine areas that have not properly bonded to substrate concrete.
2. Mark hollow areas for removal and replacement.

C. Compression Strength Test:

1. Test in accordance with ASTM C109/C109M, except modified by making samples using repair mortar.
2. Obtain production samples of mixed materials from mixer during construction for compliance with Specifications.
3. Provide minimum of three samples for each 1,000 square feet of mortar repair, and a minimum of three samples in total, whichever is greater for testing.
4. Record location where repair mortar is being applied at time production samples are obtained.

D. Direct Tension Bond Test:

1. In Situ Bond Testing: Perform tension bond test in accordance with ASTM C1583/C1583M.
2. Record locations on in situ bond tests on each type of applied repair mortar.

E. Testing laboratory retained by Contractor will provide the following:

1. Compression Strength Test:
   a. Testing will follow a “modified” ASTM C109/C109M.
   b. A minimum of three production samples of mixed material will be obtained from each 1,000 square feet of mortar repair, and a minimum of three samples in total, whichever is greater, for testing at 7 days, and 28 days.
   c. Record location where repair mortar is being applied at time production samples are obtained.

F. Retest mortar repairs that do not meet test requirements.

G. Repair and fill holes using same repair mortar where core samples have been removed.

3.07 MORTAR REPAIR FAILED TEST

A. Remove and replace unacceptable Work.

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B. Hollow Sounding Areas: Saw cut hollow sounding areas to a new square edge, remove unsound mortar repair. Prepare substrate surface and reapply repair mortar as specified herein above.

C. Failed Compression Strength Test: Remove affected areas of repair mortar represented by failed compression strength test results. Prepare substrate surface and reapply repair mortar as specified herein above.

D. Failed Bond Tests: Remove affected areas of repair mortar represented by failed bond test results. Prepare substrate surface and reapply repair mortar as specified herein above.

E. Retest areas where repair mortar was removed and replaced, in accordance with test requirements specified herein above.

3.08 CLEANING

A. Remove excess repair mortar materials as the Work proceeds. Remove waste materials, unsound material from concrete surfaces, material chipped from structure, and water used in preparation of repair areas, finishing, and curing, and dispose offsite at approved disposal site as specified in Section 01 50 00, Temporary Facilities and Controls.

END OF SECTION

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SECTION 03 15 00
CONCRETE JOINTS AND ACCESSORIES

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Waterstops.
   b. Premolded joint fillers.
   c. Pourable joint fillers.
   d. Accessories not specified in other sections.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Acceptance at Site: Verify delivered materials are in accordance with Specifications, regulatory agencies, and Manufacturer's product data sheets prior to unloading and storing onsite.

B. Storage: Store materials under tarps to protect from oil, dirt, and sunlight or as required by Manufacturer.

PART 2 PRODUCTS

2.01 HYDROPHILIC WATERSTOP

A. For use at construction joints only, where new concrete is placed against existing concrete and as shown on Drawings.

B. Material shall be a nonbentonite hydrophilic rubber compound.

C. Manufacturers and Products:

1. Greenstreak Plastic Products, St. Louis, MO; Hydrotite CJ-1020-2K with Leakmaster LV-1 adhesive and sealant.
2. Adeka Ultra Seal, JLM Associates, Spearfish, SD; MC-2010M with 3M-2141 adhesive and P-201 sealant.

2.02 PREMOLDED JOINT FILLER

A. Bituminous Type: ASTM D994 or ASTM D1751.

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B. Sponge Rubber:

1. Neoprene, closed-cell, expanded; ASTM D1056, Type 2C5, with compression deflection, 25 percent deflection (limits), 119 kPa to 168 kPa (17 psi to 24 psi) minimum. Use in joints for potable and nonpotable water containment structures.
2. Manufacturer and Product: Monmouth Rubber and Plastics, Corp, Long Branch, NJ; Durafoam DK5151.

2.03 POURABLE JOINT FILLERS

A. General: Although product is a sealant, it is being specified as a filler to prevent debris accumulation and allow expansion and contraction under shrinkage and thermal loads. It does not need to meet proportional sealant geometry requirements.

B. Filler for Potable or Non-Potable Water Containment Structures:

1. Multicomponent sealant, self-leveling or nonsag as required for level, sloping, or vertical joints.
2. Color: White.
3. Manufacturer and Product: Sika Corp., Lyndhurst, NJ; Sikaflex-2c SL.

C. Filler for Nonpotable Water Containment Structures Only:

1. Pourable, two-component, cold-applied compound meeting ASTM C920, Type M, Grade P, Class 25, Use T.
2. Color: Black.
3. Manufacturer and Product: W.R. Meadows, Inc., Elgin, IL; Gardox.

2.04 ACCESSORIES

A. Joint Sealant:

B. One-Part Polyurethane, Immersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturers and Products for Nonsag:
   a. Sika Chemical Corp.; Sikaflex-1a.
   b. Tremco; Vulkem 116.

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4. Manufacturers and Products for Self-leveling:
   a. BASF; Sonneborn, SL-1.
   b. Tremco; Vulkem 45.
   c. Sika Chemical Corp.; Sikaflex 1c SL.

PART 3 EXECUTION

3.01 INSTALLATION OF WATERSTOPS

A. Hydrophilic Waterstop:

1. Install in accordance with manufacturer's written instructions.
2. Provide minimum of 2-1/2 inches of concrete cover over waterstop. When structure has two layers of steel reinforcement, locate centered between layers of steel or as shown.
3. Apply adhesive to concrete surface and allow to dry for specified time before applying waterstop strip.
4. Lap ends of waterstop strip together at splices and corners and join with sealant.
5. Verify that waterstop is anchored firmly in place before placing concrete. Do not allow vibrator to come into contact with waterstop.
6. Lap hydrophilic waterstop 2 feet minimum with intersecting plastic waterstops.

END OF SECTION

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SECTION 03 62 00
GROUTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Action Submittals:

1. Product data of grouts.
2. Proposed method for keeping existing concrete surfaces wet prior to placing nonshrink grout.
3. Forming method for fluid grout placements.
4. Curing method for grout.

B. Informational Submittals:

1. Manufacturer's Written Instructions:
   a. Adding fiber reinforcing to batching.
   b. Mixing of grout.
2. List of Contractor's equipment installation staff trained by grout manufacturer's representative in:
   a. Nonshrink grout installation and curing.
   b. Epoxy grout installation and curing.

PART 2 PRODUCTS

2.01 NONSHRINK GROUT AND EPOXY GROUT SCHEDULE

A. Furnish nonshrink grout (Category I, II, and III) and epoxy grout for applications as indicated in the following schedule:

Application	Temperature Range	Max. Placing Time	
	40 deg F to 100 deg F	20 Min.	Greater Than 20 Min.
Blockouts	I or II		II
Machine bases 25 hp or less	II	II	II
Baseplates	II	II	II

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Application	Temperature Range	Max. Placing Time	
	40 deg F to 100 deg F	20 Min.	Greater Than 20 Min.
Baseplates and/or soleplates with vibration, thermal movement, etc.	III or Epoxy Grout	III or Epoxy Grout	III or Epoxy Grout

2.02 NONSHRINK GROUT

A. Category I:

1. Nonmetallic and nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Test in accordance with ASTM C1107/C1107M:
   a. Grout shall have flowable consistency.
   b. Flowable for 15 minutes.
4. Grout shall not bleed at maximum allowed water.
5. Minimum strength of flowable grout, 3,000 psi at 3 days, 5,000 psi at 7 days, and 7,000 psi at 28 days.
6. Manufacturers and Products:
   a. BASF Building System, Inc., Shakopee, MN; MasterFlow 100.
   b. Euclid Chemical Co., Cleveland, OH; NS Grout.
   c. Dayton Superior Corp., Miamisburg, OH; 1107 Advantage Grout.
   d. US MIX Co., Denver, CO; US SPEC GP Grout.
   e. Five Star Products Inc., Fairfield, CT; Five Star Grout.

B. Category II:

1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M:
   a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
   b. Temperatures of 40 degrees F, 80 degrees F, and 90 degrees F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 3,500 psi at 1 day, 4,500 psi at 3 days, and 7,500 psi at 28 days.

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7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
    a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 928.
    b. Five Star Products, Inc., Fairfield, CT; Five Star Fluid Grout 100.
    c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
    d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.
    e. US MIX Co., Denver, CO; US SPEC MP Grout.

C. Category III:

1. Metallic and nongas-liberating.
2. Prepackaged aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M:
    a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
    b. Temperatures of 40 degrees F and 100 degrees F.
5. 1 hour after mixing, pass fluid grout through flow cone with continuous flow.
6. Minimum strength of fluid grout, 4,000 psi at 1 day, 5,000 psi at 3 days, and 9,000 psi at 28 days.
7. Maintain fluid consistency when mixed in 1-yard to 9-yard loads in ready-mix truck.
8. Manufacturers and Products:
    a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 885.
    b. Euclid Chemical Co, Cleveland, OH; Hi-Flow Metallic Grout.

2.03 EPOXY GROUT

A. High-strength, nonshrink, high-temperature epoxy grouting material developed for the support of heavy equipment with vibratory loads.

B. Three-component mixture of a two-component epoxy resin system (100 percent solids) with a graded, precision aggregate blend.

C. Premeasured, prepackaged system.

D. Flowable.

E. Minimum compressive strength in accordance with ASTM C579 Method B, 9,500 psi at 75 degrees F at 7 days, 11,000 psi at post cure.

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F. Maximum creep resistance in accordance with ASTM C1181 at 600 psi, 140 degrees F; 6.0 by 10^{-3} in/in.

G. Minimum bond strength in accordance with ASTM C882, 2,000 psi.

H. Minimum tensile strength in accordance with ASTM C307, 2,000 psi.

I. Maximum coefficient of thermal expansion in accordance with ASTM C531 at 73 degrees F to 210 degrees F, 23.0 by10^{-6} in/in/degrees F.

J. Working Time: Minimum 2 hours at 50 degrees F; 1.5 hours at 70 degrees F; 50 minutes at 90 degrees F.

K. Good chemical resistance.

L. Good effective bearing area.

M. Noncorrosive.

N. Moisture insensitive.

O. Modify resin and aggregate content where recommended by epoxy grout manufacturer to provide desired epoxy grout flow properties.

P. Manufacturer and Product:

1. BASF Building System, Inc., Shakopee MN; MasterFlow 648.
2. Euclid Chemical Co., Cleveland, OH; E^3-G.
3. Dayton Superior Corp., Miamisburg, OH; Pro-Poxy 2000 Normal Set.
4. Five Star Products Inc., Fairfield, CT; DP Epoxy Grout.

PART 3 EXECUTION

3.01 GROUT

A. General: Mix, place, and cure grout in accordance with grout manufacturer’s representative’s training instructions.

B. Epoxy Grout: Concrete slab shall be fully cured for 28 days to ensure excess water has evaporated. Test concrete surface for moisture in accordance with ASTM D4263 before epoxy grout is placed.

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3.02 GROUTING MACHINERY

A. Block out original concrete or finish off at distance shown below bottom of machinery base with grout. Prepare concrete surface by sandblasting, chipping, or by mechanical means to remove any soft material. Surface roughness in accordance with manufacturer's written instructions.

B. Clean metal surfaces of all paint, oil, grease, loose rust, and other foreign material that will be in contact with grout.

C. Sandblast to bright metal all metal surfaces in contact with epoxy grout in accordance with manufacturer's written instructions.

D. Set machinery in position and wedge to elevation with steel wedges, or use cast-in leveling bolts. Remove wedges after grout is set and pack void with grout.

E. Form with watertight forms at least 2 inches higher than bottom of plate.

F. Fill space between bottom of machinery base and original concrete in accordance with manufacturer's representative's training instructions.

G. If grout cannot be placed from one edge and flowed to the opposite edge, air vents shall be provided through the plate to prevent air entrapment.

H. Radius all corners of grout pad.

I. Install expansion joints for epoxy grout placement in accordance with manufacturer's written instructions.

3.03 FIELD QUALITY CONTROL

A. General:

1. Performed by Project representative's inspection staff.
2. Perform the following quality control inspections. The grout manufacturer's representative shall accompany the Project representative's inspection staff on the first installation of each size and type of equipment.

B. Evaluation and Acceptance of Nonshrink Grout:

1. Inspect the surface preparation of concrete substrates onto which nonshrink grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.

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2. Inspect preparation and application of nonshrink grout form work for conformance to the manufacturer's recommendations.
3. Conduct a final review of completed nonshrink grout installation for conformance to these Specifications.
4. Provide a flow cone and cube molds with restraining plates onsite. Continue tests during Project as demonstrated by grout manufacturer's representative.
5. Perform flow cone and bleed tests, and make three 2-inch by 2-inch cubes for each 25 cubic feet of each type of nonshrink grout used. Use restraining caps for cube molds in accordance with ASTM C1107/C1107M.
6. For large grout applications, make three additional cubes and one more flow cone test. Include bleed test for each additional 25 cubic feet of nonshrink grout placed.
7. Consistency: As specified in Article Nonshrink Grout. Flow cone test in accordance with ASTM C939. Grout with consistencies outside range requirements shall be rejected.
8. Segregation: As specified in Article Nonshrink Grout. Grout when aggregate separates shall be rejected.
9. Nonshrink grout cubes shall test equal to or greater than minimum strength specified.
10. Strength Test Failures: Nonshrink grout work failing strength tests shall be removed and replaced.
11. Perform bleeding test in accordance with ASTM C940 to demonstrate grout will not bleed.
12. Store cubes at 70 degrees F.
13. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C1107/C1107M.
14. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

C. Evaluation and Acceptance of Epoxy Grout:

1. Inspect ambient conditions during various phases of epoxy grouting installation for conformance with the epoxy grout manufacturer's requirements.
2. Inspect the surface preparation of concrete substrates onto which epoxy grout materials are to be applied, for conformance to the specified application criteria including, but not limited to, substrate profile, degree of cleanliness, and moisture.
3. Inspect the surface preparation of the metallic substrates onto which the epoxy primer is to be applied.
4. Inspect the epoxy-primed metallic substrate for coverage and adhesion.

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5. Inspect preparation and application of epoxy grout form work for conformance to the manufacturer's recommendation.
6. Verify consistency obtained is sufficient for the proper field placement at the installed temperatures.
7. Inspect and record that the "pot life" of epoxy grout materials is not exceeded during the installation.
8. Inspect epoxy grout for cure.
9. Inspect and record that localized repairs made to grout voids are in conformance with the specification requirements.
10. Conduct a final review of completed epoxy grout installation for conformance to these Specifications.
11. Compression tests and fabrication of specimens for epoxy grout shall be made in accordance to ASTM C579, Method B, at intervals during construction as selected by the Project representative. A set of three specimens shall be made for testing at 7 days, and each earlier time period as appropriate.
12. Independent testing laboratory shall prepare, store, cure, and test cubes in accordance with ASTM C579.
13. All grout, already placed, which fails to meet the requirements of these Specifications, is subject to removal and replacement at no additional cost to the Owner.

END OF SECTION

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SECTION 05 05 19
POST-INSTALLED ANCHORS

PART 1 GENERAL

1.01 DEFINITIONS

A. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

B. Embedment: Embedment values indicated are based upon depth of installation into existing concrete substrate and do not include the thickness of retrofit repair mortar.

C. Exterior Area: Location not protected from weather by a building or other enclosed structure to include buried roof structures.

D. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or wash down, and where wall or roof slab is not common to a water-holding or earth-retaining structure.

E. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or wash down, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

F. Submerged: Location at or below top of wall of open water-holding structure, such as a basin or channel, or wall, ceiling, or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Specific instructions for concrete anchor installation, including drilled hole size and depth, preparation, placement, procedures, and instructions for safe handling of anchoring systems.

B. Informational Submittals:

1. Concrete Anchors:
   a. Manufacturer’s product description and installation instructions.

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b. Current ICC-ES or IAPMO-UES Report for each type of post-installed anchor to be used.
c. Adhesive Anchor Installer Certification.

2. Passivation method for stainless steel members.
3. Hot-Dip Galvanizing: Certificate of Compliance signed by galvanizer, with description of material processed and ASTM standard used for coating.

1.03 QUALITY ASSURANCE

A. Qualifications:

1. Installers of adhesive anchors horizontally or upwardly inclined to support sustained tension loads shall be certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Installer Certification Program or equivalent.
2. Galvanized Coating Applicator: Company specializing in hot-dip galvanizing after fabrication and following procedures of Quality Assurance Manual of the American Galvanizers Association.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package stainless steel items in a manner to provide protection from carbon impregnation.

B. Protect hot-dip galvanized finishes from damage as a result of metal banding and rough handling.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Stainless Steel:	
Threaded Rods	F593, AISI Type 316, Condition CW
Nuts*	F594, AISI Type 316, Condition CW

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Item	ASTM Reference
Carbon Steel:	
Threaded Rods	F1554, Grade 36 or F568M Class 5.8
Flat and Beveled Washers (Hardened)	F436
Nuts*	A194/A194M, Grade 2H
Galvanized Steel:	
All	A153/A153M
*Nuts of other grades and styles having specified proof load stresses greater than specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than minimum tensile strength of specified threaded rod.	

B. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, and zinc-plated steel material types as indicated in Fastener Schedule at end of this section.

2.02 POST-INSTALLED CONCRETE ANCHORS

A. General:

1. AISI Type 316 stainless, hot-dip galvanized or zinc-plated steel, as shown in Fastener Schedule at end of this section.
2. Post-installed anchor systems used in concrete shall be approved by ICC Evaluation Services Report or equivalent for use in cracked concrete and for short-term and long-term loads including wind and earthquake.
3. Mechanical Anchors: Comply with the requirements of ICC-ES AC193 or ACI 355.2.
4. Adhesive Anchors: Comply with the requirements of ICC-ES AC308 or ACI 355.4.

B. Torque-Controlled Expansion Anchors (Wedge Anchors):

1. Manufacturers and Products:
   a. DeWalt/Powers Fasteners, Brewster, NY; Power-Stud +SD1, +SD2, +SD4, or +SD6 Anchors (ESR-2502 and ESR-2818).
   b. Hilti, Inc., Tulsa, OK; Kwik-Bolt –TZ (KB-TZ) Anchors (ESR-1917).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt 2 Anchors (ESR-1771 and ESR-3037).

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C. Undercut Anchors:

1. Manufacturers and Products:
   a. USP Structural Connectors, Burnsville, MN; DUC Undercut Anchor (ESR-1970).
   b. Hilti, Inc., Tulsa, OK; HDA Undercut Anchor (ESR-1546).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; TORQ-CUT Self-Undercutting Anchor (ESR-2705).
   d. DeWalt/Powers Fasteners, Brewster, NY; Atomic+ Undercut Anchor (ESR-3067).

D. Self-Tapping Concrete Screw Anchors:

1. Manufacturers and Products:
   a. DeWalt/Powers Fasteners, Brewster, NY; Wedge-Bolt+ (ESR-2526).
   b. DeWalt/Powers Fasteners, Brewster, NY; Vertigo+ Rod Hanger Screw Anchor (ESR-2989).
   c. DeWalt/Powers Fasteners, Brewster, NY; Snake+ Flush Mount Screw Anchor (ESR-2272).
   d. Hilti, Inc., Tulsa, OK; HUS-EZ Screw Anchor (ESR-3027).
   e. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Titen HD Screw Anchor (ESR-2713).

E. Adhesive Anchors:

1. Threaded Rod:
   a. Diameter as shown on Drawings.
   b. Length as required to provide minimum depth of embedment indicated and thread projection required.
   c. Clean and free of grease, oil, or other deleterious material.
2. Adhesive:
   a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
   b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
3. Packaging and Storage:
   a. Disposable, self-contained system capable of dispensing both components in proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
   b. Store adhesive on pallets or shelving in a covered storage area.
   c. Package Markings: Include manufacturer’s name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

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d. Dispose of When:
   1) Shelf life has expired.
   2) Stored other than in accordance with manufacturer's instructions.

4. Manufacturers and Products:
   a. DeWalt/Powers Fasteners, Brewster NY; Pure 110+ Epoxy adhesive anchor system (ESR-3298).
   b. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT RE 500 V3 (ESR-3814), or HIT-HY 200 (ESR-3187).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors (ESR-2508), or AT-XP Adhesive Anchors (IAPMO UES-263).

PART 3 EXECUTION

3.01 CONCRETE ANCHORS

A. Begin installation only after concrete to receive anchors has attained design strength.

B. Locate existing reinforcing with Ground Penetrating Radar or other method approved by Engineer prior to drilling. Coordinate with Engineer to adjust anchor locations where installation would result in hitting reinforcing.

C. Install in accordance with written manufacturer's instructions.

D. Provide minimum embedment, edge distance, and spacing as indicated on Drawings.

E. Use only drill type and bit type and diameter recommended by anchor manufacturer.

F. Clean hole of debris and dust per manufacturer's requirements.

G. When unidentified embedded steel, rebar, or other obstruction is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than indicated in manufacturer's installation instructions to clear obstruction, notify Engineer for direction on how to proceed.

H. Adhesive Anchors:

1. Unless otherwise approved by Engineer and adhesive manufacturer:
   a. Do not install adhesive anchors when temperature of concrete is below 40 degrees F or above 100 degrees F.
   b. Do not install prior to concrete attaining an age of 21 days.

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c. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry.
d. Do not disturb anchor during recommended curing time.
e. Do not exceed maximum torque as specified in manufacturer's instructions.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Owner-Furnished Quality Assurance, in accordance with IBC Chapter 17 requirements. Contractor responsibilities and related information are included in Section 01 45 33, Special Inspection, Observation, and Testing.

B. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

3.03 MANUFACTURER'S SERVICES

A. Adhesive and Mechanical Anchors: Conduct Site training of installation personnel for proper installation, handling, and storage of adhesive anchor system. Notify Engineer of time and place for sessions.

3.04 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

Service Use and Location	**Product**	**Remarks**
1. Post-Installed Anchors for Metal Components to Cast-in-Place Concrete (such as, Ladders, Handrail Posts, Electrical Panels, Platforms, and Equipment)		
Interior Dry Areas	Stainless steel adhesive or mechanical anchors	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application

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Service Use and Location	Product	Remarks
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel adhesive anchors	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application
2. All Others		
All service uses and locations	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on all stainless steel threads.

C. Provide bolt insulating kit where bolt material and fastened equipment are dissimilar materials.

D. Do not use adhesive anchors to support fire-resistive construction or where ambient temperature will exceed 120 degrees F.

END OF SECTION

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SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   c. A924/A924M Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
   d. B32, Standard Specification for Solder Metal.
   e. C920, Standard Specification for Elastomeric Joint Sealants.
   f. C1311, Standard Specification for Solvent Release Sealants.
   g. D4586/D4586M, Standard Specification for Asphalt Roof Cement, Asbestos-Free.
2. FM Global (FM): Loss Prevention Data Sheet 1-49, Perimeter Flashing.
3. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): 1793, Architectural Sheet Metal Manual.

1.02 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA 1793. Conform to dimensions and profiles shown, unless more stringent requirements are indicated.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Show joints, types and location of fasteners, and special shapes.
   b. Catalog data for stock manufactured items.

1.04 DELIVERY, HANDLING, AND STORAGE

A. Inspect for damage, dampness, and wet storage stains upon delivery to Site.

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B. Remove and replace damaged or permanently stained materials that cannot be restored to like-new condition.

C. Carefully handle to avoid damage to surfaces, edges, and ends.

D. Do not open packages until ready for use.

E. Store materials in dry, weathertight, ventilated areas until immediately before installation.

PART 2 PRODUCTS

2.01 METAL

A. Galvanized Sheet Steel: ASTM A924/A924M, Grade A or ASTM A653/A653M, G90 zinc coating, commercial quality copper bearing steel, thickness 0.0239-inch (24 U.S. Standard gauge), unless otherwise shown.

2.02 ANCILLARY MATERIALS

A. Solder: ASTM B32, alloy composition Sn 50.

B. Soldering Flux: ASTM B32, Type RA.

C. Sealing Tape: Polyisobutylene sealing tape.

D. Isolation Paint: As specified in Section 09 90 00, Painting and Coating.

E. Isolation Tape: Butyl or polyisobutylene, internally reinforced, or 20-mil thick minimum polyester.

F. Elastomeric Sealant: ASTM C920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

G. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

H. Fasteners:

1. Galvanized Steelwork: Steel, galvanized per ASTM A153/A153M or stainless steel fasteners.

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2.03 FABRICATION OF FLASHING

A. Field measure prior to fabrication.

B. Fabricate in accordance with SMACNA 1793 that applies to design, dimensions, metal, and other characteristics of item indicated.

C. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

D. Fabricate sheet metal flashing and trim without excessive oil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

E. Seams:

1. Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.

F. Reinforcements and Supports: Provide same material as flashing, unless other material is shown. Steel, where shown or required, shall be galvanized or stainless.

G. Rigid Joints and Seams: Make mechanically strong. Solder galvanized metal joints. Do not use solder to transmit stress.

H. Sealed Joints: Form nonexpansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

I. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1-inch deep, filled with butyl sealant concealed within joints.

J. Fabricate sheet metal in 10-foot maximum lengths, unless otherwise indicated.

K. Provide watertight closures at exposed ends of counterflashing.

L. Fabricate corners in one-piece with legs extending 30 inches each way to field joint. Lap, rivet, or solder corner seams watertight. Apply sealant if necessary.

M. Neutralize soldering flux.

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N. Solvent clean sheet metal. Surfaces to be in contact with roofing or otherwise concealed shall be coated with isolation paint.

O. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

P. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA 1793 and FM Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify nailing strips and blocking are properly located.

B. Verify membrane termination and base flashings are in place, sealed, and secure.

3.02 INSTALLATION

A. Flashing:

1. General:
   a. Install sheet metal roof flashing and trim to comply with performance requirements and SMACNA 1793.
   b. Provide concealed fasteners where possible, set units true to line, and level as indicated.
   c. Install work with laps, joints, and seams that will be permanently watertight.
2. Isolate metal from wood and concrete and from dissimilar metal with isolation tape or two coats of isolation paint.
3. Use only stainless steel fasteners to connect isolated dissimilar metals.
4. Joints: 10-foot maximum spacing and 2-1/2 feet from corners, butted with 3/16-inch space centered over matching 8-inch-long backing plate with sealing tape in laps.
5. Joints, Fastenings, Reinforcements, and Supports: Sized and located as required to preclude distortion or displacement as a result of thermal expansion and contraction.
6. Conceal fastenings wherever possible.
7. Set flashing and sheet metal to straight, true lines with exposed faces aligned in proper plane without bulges or waves.

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3.03 FINISH

A. Exposed Surfaces of Flashing and Sheet Metalwork: Free of dents, scratches, abrasions, or other visible defects, and clean and ready for painting where applicable.

B. For exposed outdoor galvanized steel, prepare and prime coat in accordance with Section 09 90 00, Painting and Coating, System No. 10. Finish coat with Polyurethane Enamel in accordance with Section 09 90 00, Painting and Coating, System No. 4.

3.04 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

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SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C661, Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer.
   b. C920, Standard Specification for Elastomeric Joint Sealants.
   c. C1193, Standard Guide for Use of Joint Sealants.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Surface preparation instructions. Indicate where each product is proposed to be used.
2. Samples: Material proposed for use showing color range available.

B. Informational Submittals:

1. Installation instructions.
2. Documentation showing applicator qualifications.
3. Manufacturer’s Certificate of Compliance.
4. Special guarantee.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum of 5 years’ experience installing sealants in projects of similar scope.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Ambient Temperature: Between 40 degrees F and 80 degrees F (4 degrees C and 27 degrees C) when sealant is applied. Consult manufacturer when sealant cannot be applied within these temperature ranges.

1.05 SPECIAL GUARANTEE

A. Product: Furnish manufacturer’s extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall

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provide for correction or, at the option of the Owner, removal and replacement of Work specified in this section found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

B. Conditions: No adhesive or cohesive failure of sealant.

C. Sealed Joints: Watertight and weathertight with normal usage.

PART 2 PRODUCTS

2.01 SEALANT MATERIALS

A. Characteristics:

1. Uniform, homogeneous.
2. Free from lumps, skins, and coarse particles when mixed.
3. Nonstaining, nonbleeding.
4. Hardness of 15 minimum and 50 maximum, measured by ASTM C661 method.
5. Immersible may be substituted for nonimmersible.

B. Color: Unless specifically noted, match color of the principal material adjoining area of application.

C. Type 1—Silicone, Nonsag, Nonimmersible:

1. Silicone base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Capable of withstanding movement up to 50 percent of joint width.
3. Manufacturers and Products:
   a. Dow Corning Corp.; No. 790.
   b. General Electric; Silpruf SCS2000.
   c. BASF; Sonneborn, Omniseal-50.

D. Type 5—One-part Polyurethane, Immersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
2. Capable of being continuously immersed in water.
3. Manufacturers and Products for Nonsag:
   a. Sika Chemical Corp.; Sikaflex-1a.
   b. Tremco; Vulkem 116.

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4. Manufacturers and Products for Self-leveling:
   a. BASF; MasterSeal, SL-1.
   b. Tremco; Vulkem 45.
   c. Sika Chemical Corp.; Sikaflex 1c SL.

E. Type 6—One-part Polyurethane, Nonimmersible:

1. Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS, Class 25.
2. Manufacturers and Products:
   a. Pecora Corp.; Dynatrol 1 XL.
   b. Tremco; Dymonic.
   c. BASF; MasterSeal, NP-I.

F. Type 7—Multipart Polysulfide, Immersible:

1. Polysulfide base, two-component, chemical curing; ASTM C920, Type M, Grade P or NS, Class 25.
2. Capable of being continuously immersed in water.
3. For use above grade and below grade.
4. Manufacturers and Products:
   a. W. R. Meadows; Deck-O-Seal Gun Grade, two-part.
   b. BASF; Sonolastic, two-part Polysulfde.

G. Type 13—Tape Sealant:

1. Compressible polyurethane foam impregnated with polybutylene or polymer-modified asphalt.
2. Color: Black.
3. Size: 3/4 inch wide by length required by expanded thickness recommended by manufacturer for particular application.
4. Manufacturers and Products:
   a. Emseal Joint Systems, Ltd.; AST—High Acrylic.
   b. Dayton Superior; Polytite Standard.
   c. PARR Technologies; PARR Sealant EP-7212-T.

2.02 BACKUP MATERIAL

A. Nongassing, extruded, closed-cell round polyurethane foam or polyethylene foam rod, compatible with sealant used, and as recommended by sealant manufacturer.

B. Size: As shown or as recommended by sealant material manufacturer. Provide for joints greater than 3/16 inch wide.

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C. Manufacturers and Products:

1. BASF; MasterSeal 920, Closed-cell Backing Rod.
2. Tremco; Closed-cell Backing Rod.
3. Pecora Corporation; Green Rod.

2.03 ANCILLARY MATERIALS

A. Bond Breaker: Pressure sensitive tape as recommended by sealant manufacturer to suit application.

B. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer; compatible with joint forming materials.

C. Primer: Nonstaining type recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 GENERAL

A. Use of more than one material for the same joint is not allowed unless approved by sealant manufacturer.

B. Install joint sealants in accordance with ASTM C1193.

C. Horizontal and Sloping Joints up to 1 Percent Maximum Slope: Use self-leveling (Grade P) joint sealant.

D. Steeper Sloped Joints, Vertical Joints, and Overhead Joints: Use nonsag (Grade NS) joint sealant.

E. Use joint sealant as required for the applicable application and as follows:

Joint Size	Sealant Type
Less than 1"	1, 5, 6, or 7
Less than 2"	1 or 7
Over 2"	Follow manufacturer’s recommendation

3.02 PREPARATION

A. Verify that joint dimensions, and physical and environmental conditions, are acceptable to receive sealant.

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B. Surfaces to be sealed shall be clean, dry, sound, and free of dust, loose mortar, oil, and other foreign materials.

1. Mask adjacent surfaces where necessary to maintain neat edge.
2. Starting of work will be construed as acceptance of subsurfaces.
3. Apply primer to dry surfaces as recommended by sealant manufacturer.

C. Verify joint shaping materials and release tapes are compatible with sealant.

D. Examine joint dimensions and size materials to achieve required width/depth ratios.

E. Follow manufacturer’s instructions for mixing multi-component products.

3.03 INSTALLATION

A. Use joint filler to achieve required joint depths, to allow sealants to perform intended function.

1. Install backup material as recommended by sealant manufacturer.
2. Where possible, provide full length sections without splices; minimize number of splices.
3. Tape sealant may be used as joint filler if approved by sealant manufacturer.

B. Use bond breaker where recommended by sealant manufacturer.

C. Seal joints around door frames, expansion joints, control joints, and elsewhere as indicated.

D. Joint Sealant Materials: Follow manufacturer’s recommendation and instructions, filling joint completely from back to top, without voids.

E. Joints: Tool slightly concave after sealant is installed.

1. When tooling white or light color sealant, use a water wet tool.
2. Finish joints free of air pockets, foreign embedded matter, ridges, and sags.

F. Tape Sealant: Compress to 50 percent of expanded thickness and install in accordance with manufacturer’s instructions.

3.04 PREFORMED SEALS

A. Prepare joint surfaces clean and dry, free from oil, rust, laitance, and other foreign material.

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B. Construct joints straight and parallel to each other and at proper width and depth.

C. Apply joint sealant manufacturer's approved primer and adhesive in accordance with manufacturer's instructions.

D. Install seal in accordance with manufacturer's instructions.

3.05 CLEANING

A. Clean surfaces next to the sealed joints of smears or other soiling resultant of sealing application.

B. Replace damaged surfaces resulting from joint sealing or cleaning activities.

3.06 JOINT SEALANT SCHEDULE

A. This schedule lists the sealant types acceptable for each joint location. Use as few different sealant types as possible to meet the requirements of Project.

Joint Locations	Sealant Type(s)
Expansion/Contraction and Control Joints At:	
Concrete Walls and Slabs immersed in water and/or below grade	7
Precast Concrete Wall Panels	5, 13
Material Joints At:	
Metal Door Frames (Exterior)	1, 5, 6
Metal Door Frames (Interior)	1, 5, 6
Wall Penetrations (Exterior)	1, 5, 6
Wall Penetrations (Interior)	1, 5, 6
Floor Penetrations	5, 6
Roof Penetrations	5
Precast Concrete Wall Panels	5, 13

END OF SECTION

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SECTION 08 11 00
METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. A250.6, Hardware on Standard Steel Doors (Reinforcement - Application).
   b. A250.8, Recommended Specification for Standard Steel Doors and Frames.
   c. A250.11, Recommended Erection Instructions for Steel Frames.
2. ASTM International (ASTM):
   a. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   b. A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
   c. C1048, Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
   d. C1376, Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass.
   e. E2190, Standard Specification for Insulating Glass Unit Performance and Evaluation.
3. Builders Hardware Manufacturers Association (BHMA): A156.115, Hardware Preparations in Standard Steel Doors and Frames.
4. Consumer Product Safety Commission (CPSC) Code of Federal Regulations (CFR): 16 CFR 1201, Safety Standard for Architectural Glazing Materials.
5. National Fenestration Rating Council Incorporated (NFRC):
   a. 100, Procedure for Determining Fenestration Product U-Factors.
   b. 200, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence.
   c. 300, Standard Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.
6. UL: Building Materials Directory.

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1.02 SUBMITTALS

A. Action Submittals:

1. Applicable information for each type of door and frame, including:
   a. Frame conditions and complete anchorage details, supplemented by suitable schedules covering doors and frames.
   b. Glass opening sizes and locations in doors.
   c. Connections of door frames to structural steel framing concealed in frames.
   d. Location and field splice joints for frames too large to ship in one piece; indicate complete instructions for making field splices.
   e. Relate to door numbers used in Contract Drawings.
2. Applicable information for glass and glazing material to be used, including:
   a. Catalog cuts of glazing materials and accessories.
   b. Glass: Provide structural, physical, thermal, and solar optical performance characteristics, size limitations, special handling or installation requirements.
   c. Glazing Sealants, Compounds, and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors where exposed.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Properly identify each item with number used in Contract Drawings.

B. Store doors upright, in protected dry area, at least 1 inch off ground or floor and at least 1/4 inch between individual pieces.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Curries Manufacturing.
2. The Ceco Corp.
3. Overly Manufacturing Co.
4. Steelcraft Manufacturing Co.

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2.02 MATERIALS

A. Basic Metal Material: ASTM A1008/A1008M; sheet steel, cold-rolled, stretcher level.

B. Hollow Metal Frames:

1. Products of hollow metal door manufacturer.
2. ANSI 250.8, except as modified herein.
3. Frames for Doors and Relights: 14 gauge with thermal break, for exterior, welded type, of cross-section shown.
4. Prepare floor and wall anchors, reinforcement, and cutouts for hardware to meet requirements of BHMA A156.115 and ANSI A250.6.
5. Finished size, shape, and profile of frame members as shown.
6. Concealed fasteners or welding are preferred to through-the-face fasteners.
7. Identification: Stamp opening number, as shown on Drawings, on center hinge reinforcement of each frame.

C. Hollow Metal Doors: ANSI A250.8, except as modified herein. BHMA A156.115 and ANSI A250.6 to receive hardware specified in Door and Hardware Schedule.

1. Exterior:
   a. Flush Panel Doors: 16 gauge, Level 3, Model 2.
   b. Flush end closure at top of doors.
   c. Polyurethane Core, R-Value: 8.

D. Glazing:

1. Doors and Relights: Furnish with formed flush-type glazing strips with butt corner joints to permit selection of secure side in field.
2. Provide glass to resist loads as provided in general structural notes on Drawings.
3. Thermal and Solar Optical Performance: Measured or calculated in accordance with the following:
   a. U-Values: NFRC 100.
   b. Solar Heat Gain Coefficients: NFRC 200.
   c. Solar Optical Properties: NFRC 300.

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E. Float Glass Materials:

1. Tempered Glass:
   a. ASTM C1048, Type 1 transparent flat, Quality Q3, Kind FT fully tempered, Condition A uncoated, float glass with horizontal tempering.
   b. Conforming to CPSC 16 CFR 1201 Category II at locations where safety glass is required by applicable code.

F. Float Glass Products:

1. Clear Glass:
   a. Tempered (TG) float glass as specified; Class 1 clear.
   b. Minimum Thickness: 1/4 inch unless otherwise indicated.

G. Insulating Glass – Clear (IG-C): ASTM E2190 certified by Insulating Glass Certification Council and Insulating Glass Manufacturers Alliance.

1. Total Unit Thickness: 1 inch.
2. Outer Pane: Glass Type Clear Tempered Glass (TG), with Low-E coating on inner surface (No. 2 position).
   a. Low-E Coating: ASTM C1376; pyrolytic or vacuum deposited.
3. Inner Pane: Glass Type Clear Tempered Glass (TG).
4. Argon-filled space between lites.
5. Visible Light Transmittance: 70 percent minimum.
6. Solar Heat Gain Coefficient: 0.4 maximum.
7. U-Factor Winter: 0.35 maximum.
8. Manufacturer and Product:
   a. Vitro Architectural Glass; Solarban 60.
   b. “Or-equal.”

2.03 MISCELLANEOUS ITEMS

A. Furnish manufacturer’s standard anchors, fasteners, and other ancillary items.

2.04 FACTORY FINISHING REQUIREMENTS

A. Shop prepare and prime coat per System No. 4 as specified in Section 09 90 00, Painting and Coating.

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PART 3 EXECUTION

3.01 INSTALLATION

A. Frames:

1. Follow ANSI A250.11 and manufacturer's instructions.
   a. Maintain scheduled dimensions, hold head level, and maintain jambs plumb and square.
   b. Secure anchorages and connections to adjacent construction.
   c. Wherever possible, leave frame spreader bars intact until frames are set perfectly square and plumb and anchors are securely attached.

B. Doors:

1. Hollow Metal Doors: ANSI A250.8.
2. Hardware: In accordance with manufacturer's templates and instructions.
   a. Adjust operable parts for correct function.
   b. Remove hardware, with exception of prime coated items, tag, box, and reinstall after finish paint work is completed.

3.02 FIELD PAINTING

A. Finish coat per System No. 4 in accordance with Section 09 90 00, Painting and Coating.

B. Where prime coat has been damaged, sand smooth and touch up with same primer as applied at shop.

1. Remove rust before painting.
2. Touch Up: Not obvious.
3. Perform immediately after door and frame installation.

3.03 PROTECTION

A. Protect installed doors and frames against damage from other construction work.

3.04 SCHEDULES

A. For tabulation of door and frame characteristics, such as size, type, detail, and finish hardware requirements, see Door and Hardware Schedule on Drawings.

END OF SECTION

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SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Builders Hardware Manufacturer's Association (BHMA):
   a. A156.1, Butts and Hinges.
   b. A156.2, Bored and Preassembled Locks and Latches.
   c. A156.4, Door Controls - Closers.
   d. A156.13, Mortise Locks & Latches.
   e. A156.16, Auxiliary Hardware.
   f. A156.18, Materials and Finishes.
2. International Code Council (ICC): A117.1, Accessible and Usable Buildings and Facilities.
3. UL: Fire Protection Equipment List.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product Data: Manufacturer's literature for each item of finish hardware required herein, clearly marked.
   b. Finish Hardware Schedule: Furnish complete and detailed schedule, show product items, numbers, and finishes for hardware for each separate opening.
   c. Special Tools: Provide listing and description of usage.

B. Informational Submittals:

1. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
2. Manufacturer's Field Service Report.
3. Certification of Hardware Consultant.
4. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.

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1.03 QUALITY ASSURANCE

A. Qualifications of Supplier: Recognized supplier of architectural finish hardware, with warehousing facilities, who has been furnishing hardware in vicinity of Project for not less than 5 years, and who is, or who employs, architectural hardware consultant.

B. Qualifications of Architectural Hardware Consultant (AHC): Certified by Door and Hardware Institute.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Before delivery, clearly identify and tag each item of hardware with respect to specified description and location of installation.

B. Provide secure storage for finish hardware until installation is made.

1.05 EXTRA MATERIALS

A. Special Tools: Two sets for installation and maintenance of hardware.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide end products of one manufacturer for each product in order to achieve standardization for appearance, maintenance, and replacement.

B. Finishes: BHMA A156.18.

2.02 FASTENERS

A. Stainless steel.

2.03 BUTT HINGES

A. BHMA A156.1.

B. Quantity per Door Leaf (Minimum):

Door Height	Hinges
5'-1" to 7’-7”	1-1/2 pair

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C. Hinge Height (Minimum):

Door Width	Hinge Height
Up to 3'-0"	4-1/2"

D. Width: Minimum for clearance of trim and 180-degree swing.

E. Exterior Hinges: Nonremoveable pin.

F. Joint Tolerance: 0.012 inch maximum, gauged in CLOSED position.

G. Finish: Satin chromium-plated brass or bronze No. 626.

H. Types and Manufacturers:

No.	Type Description	Stanley	Mc-Kinney	Lawrence	BHMA
H1	Regular weight, two ball-races, full mortise, stainless steel	FBB191-26D	TB2314	BB4101-26D	A5112

2.04 LOCKS AND LATCH SETS

A. Cylindrical or Bored Locks: BHMA A156.2, highest grade.

1. Trim: Wrought or cold-forged metal knobs and roses.
2. Core Cylinders: Interchangeable, removable; minimum of six pins.
3. Strikes: Lip dimensions to fit configuration of trim.
4. Bolt Throw: 3/4 inch minimum, on latchbolts for pair of doors.
5. Knob Backset: 3-3/4 inches.
6. Manufacturers and Products: Schlage; ND Rhodes currently being used on site, “or-equal.”

B. Finish: Satin chromium-plated No. 626.

C. Locks and Latches: Match existing in manufacturer, design, finish, and keying. No substitutions allowed.

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D. Types and Manufacturers:

No.	Type Description	Schlage
L2	Cylindrical, Entrance lock	ND53PD
L16	Lock by exit device manufacturer; furnish cylinders for keying to other locks as required	

E. Keying:

1. Lock Cylinders: Operate by existing master key system.
2. Keylocks: Key new locks into existing Best master key system, as directed by Owner.
3. Keys: Two per lock; tag with schedule information.
4. Master Keys: Four; send by registered mail to Owner.

2.05 CONSTRUCTION KEY SYSTEM

A. Removable construction core system for locks.

B. See Article Manufacturer's Services under Part 3, Execution.

2.06 ELECTRONIC DOOR HARDWARE

A. Coordinate products and execution specified in this section to provide a completely integrated and functional system.

B. Notify Engineer immediately if products or installation requirements are incompatible.

C. Provide a completely integrated and functional system as indicated for each separate opening listed in the Door and Hardware Schedules on Drawings.

D. Types and Manufacturers:

No.	Type Description	Manufacturer	Product
EX1	Electric Exit Device (Rim Type)	Von Duprin, "or-equal"	EL99L
	Electrified Removable Mullion, non-locking	Von Duprin, "or-equal"	4854

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E. Trim, Finish, and Keying: As specified for similar, nonelectric products.

2.07 CLOSERS

A. BHMA A156.4.

B. Size closers in accordance with manufacturer's standards. Mount regular arm closers on pull side of doors. Mount parallel arm closers on push side of doors. On pair of doors provide closer on active leaf only, unless noted otherwise.

C. Finish: Satin chromium-plated No. 626.

D. Types and Manufacturers:

No.	Type/Description	LCN	Sargent	BHMA
C2	Parallel arm	4110 Series	351-P Series	C02021

2.08 STOPS AND HOLDERS

A. BHMA A156.16.

B. Machine Screws: In threaded anchors at concrete or masonry.

C. Self-Tapping Screws: At stud partitions, wood, or metal mountings.

D. Finish: Satin chromium-plated No. 626.

E. Types and Manufacturers for Each Leaf:

No.	Type Description	BBW or GJ	Baldwin	BHMA
S6	Overhead stop	GJ90S Series	Sargent 590S Series	C02511

2.09 KICKPLATES

A. Solid metal, not plated. Bevel four edges.

B. Width of door leaf less than 1-1/2 inches at single leaf and less than 1 inch at pairs.

C. Finish: Satin stainless steel No. 630.

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D. Types and Manufacturers:

1. Rockwood, as follows:
   a. K1: 10 inches high by 0.125 inch thick.

2.10 THRESHOLDS

A. Thresholds: One-piece full width of opening; extend beyond jamb where indicated.

B. Provide with stainless steel machine screws in threaded expansion anchors at concrete.

C. Finish: Mill finish aluminum, unless indicated otherwise.

D. Types and Manufacturers:

No.	Type Description	Pemko	Reese
T1	Saddle (smooth, 4" x 1/2")	175A	S104A

2.11 WEATHERSTRIP

A. Finish: Clear anodized aluminum, unless indicated otherwise.

B. Seal Types and Manufacturers:

No.	Type Description	Pemko	Reese
W1	Rubber or vinyl bulb at jambs and head, and at meeting stiles of pairs	S88D	797B
	Door shoe	222AV	DB596AF
	Rain drip	346C	R201C

2.12 SILENCERS

A. Ives, Glynn-Johnson.

B. At metal frame of each hinged door that does not have seals scheduled.

C. Three at single leaves and two at pairs.

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2.13 TEMPLATES

A. Fabricate to template hardware applied to metal doors and frames.

B. Ensure that required templates are furnished to various manufacturers for fabrication purposes.

C. Templates: Make available not more than 10 days after receipt of approved Hardware Schedule.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with manufacturer's written instructions.

B. Make Work neat and secure, develop full strength of components, and provide proper function.

C. Prevent marring, scratching, or otherwise damaging adjacent finishes during hardware installation.

D. Latchbolts:

1. Install to engage in strikes automatically, whether activated by closers or manually.
2. In no case shall additional manual pressure be required to engage latchbolt in strike.

E. Stops and Holders: Set to allow doors to open as far as possible.

F. Wall Mounted Hardware: Install over solid structural backing or solid blocking in hollow walls.

G. Thresholds:

1. Cope ends neatly to profile of jamb.
2. Set in sealant and seal ends to jambs.

H. Hardware: Adjust for easy, noise-free operation.

I. Replace damaged hardware items.

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3.02 MOUNTING DIMENSIONS

A. Standard Door Hardware Locations: As recommended and published by Door and Hardware Institute, except as noted or detailed otherwise.

B. Door Silencers: Install 3 inches from top and bottom of jamb and 1 inch above strike at single doors, and 3 inches from edges of doors in head for pairs of doors.

3.03 MANUFACTURER'S SERVICES

A. Deliver permanent lock cores to Site.

B. Remove temporary construction cores and insert permanent cores.

C. Inspect each lock set to ensure permanent cores are operating satisfactorily.

D. Deliver to Owner change and control keys for permanent system.

E. Return temporary construction cores to manufacturer.

F. Furnish manufacturer's representative for the following services at Site or classroom as designated by Owner, for minimum person-days listed below, travel time excluded:

1. 1/4 person-day for installation assistance, inspection, and Manufacturer's Certificate of Proper Installation.
2. 1/4 person-day for functional and performance testing.

3.04 PROTECTION

A. Cover and protect exposed surfaces of hardware during installation and until Substantial Completion.

B. Fit, dismantle, and reinstall finish hardware as required for finish painting work.

C. Protect and prevent staining of hardware during construction in accordance with manufacturer's recommendations.

D. Remove protective measures and permanent lock cylinders installed prior to final cleaning.

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3.05 DOOR AND HARDWARE SCHEDULE

A. Door and Hardware Schedule on Drawings is guide to functional requirements of each opening.

B. Provide finish hardware as scheduled. Sizes omitted shall be as recommended by manufacturer.

3.06 HARDWARE SETS

HDW-1:	**Item**	**Type**
	3 Pair butts	H1
	2 Exit devices (rim type) with cylinders for keying to other locks as required	EX1/L16
	1 Removable mullion (electric for future access control retrofit)	EX1
	2 Closers	C2
	2 Overhead Stops	S6
	2 Metal kickplates	K1
	1 Threshold	T1
	1 Set weatherstrip	W1
HDW-2:	**Item**	**Type**
	1-1/2 Pair butts	H1
	1 Lock	L2
	1 Closer	C2
	1 Overhead stop	S6
	1 Metal kickplate	K1
	1 Threshold	T1
	1 Set weatherstrip	W1

END OF SECTION

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SECTION 09 90 00
PAINTING AND COATING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Environmental Protection Agency (EPA).
2. NACE International (NACE): SP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
3. National Association of Pipe Fitters (NAPF): NAPF 500-03, Surface Preparation Standard for Ductile Iron Pipe and Fittings in Exposed Locations Receiving Special External Coatings and/or Special Internal Linings.
4. Occupational Safety and Health Act (OSHA).
5. The Society for Protective Coatings (SSPC):
   a. PA 2, Procedure for Determining Conformance to Dry Coating Thickness Requirements.
   b. PA 10, Guide to Safety and Health Requirements for Industrial Painting Projects.
   c. SP 1, Solvent Cleaning.
   d. SP 2, Hand Tool Cleaning.
   e. SP 3, Power Tool Cleaning.
   f. SP 5, White Metal Blast Cleaning.
   g. SP 6, Commercial Blast Cleaning.
   h. SP 7, Brush-Off Blast Cleaning.
   i. SP 10, Near-White Metal Blast Cleaning.
   j. SP 11, Power Tool Cleaning to Bare Metal.
   k. SP 13, Surface Preparation of Concrete.
   l. SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
   m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. FRP: Fiberglass Reinforced Plastic.
3. HCl: Hydrochloric Acid.

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4. MDFT: Minimum Dry Film Thickness, mils.
5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
6. Mil: Thousandth of an inch.
7. PPDS: Paint Product Data Sheet.
8. PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Data Sheets:
      1) For each product, furnish a Paint Product Data Sheet (PPDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PPDS form is appended to the end of this section.
      2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
      3) Technical and performance information that demonstrates compliance with specification.
      4) Furnish copies of paint system submittals to the coating applicator.
      5) Indiscriminate submittal of only manufacturer's literature is not acceptable.
   b. Detailed chemical and gradation analysis for each proposed abrasive material.

B. Informational Submittals:

1. Applicator's Qualification: List of references substantiating experience.
2. Coating manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services.
3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified.
4. Manufacturer's written verification that submitted material is suitable for the intended use.

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5. If the manufacturer of finish coating differs from that of shop primer, provide finish coating manufacturer's written confirmation that materials are compatible.
6. Manufacturer's written instructions and special details for applying each type of paint.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications: Minimum 5 years' experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting the emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer's instructions.
   b. SSPC PA 10.
   c. Federal, state, and local agencies having jurisdiction.

C. Mockup:

1. Before proceeding with Work under this section, finish one complete space or item of each color scheme required showing selected colors, finish texture, materials, quality of work, and special details.
2. After Engineer approval, sample spaces or items shall serve as a standard for similar work throughout the Project.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping:

1. Where precoated items are to be shipped to the Site, protect coating from damage. Batten coated items to prevent abrasion.
2. Protect shop painted surfaces during shipment and handling by suitable provisions including padding, blocking, and use of canvas or nylon slings.

B. Storage:

1. Store products in a protected area that is heated or cooled to maintain temperatures within the range recommended by paint manufacturer.

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2. Primed surfaces shall not be exposed to weather for more than 2 months before being top coated, or less time if recommended by coating manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures or moisture conditions outside of manufacturer's recommended maximum or minimum allowable.
2. Do not perform final abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dew point of ambient air.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Nationally recognized manufacturers of paints and protective coatings who are regularly engaged in the production of such materials for essentially identical service conditions.

B. Minimum of 5 years' verifiable experience in manufacture of specified product.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. Akzo Nobel (International; Devoe).
2. Carboline.
3. PPG.
4. Sherwin-Williams.
5. Tnemec.

2.02 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.03 PAINT MATERIALS

A. General:

1. Manufacturer's highest quality products suitable for intended service.

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2. Compatibility: Only compatible materials from a single manufacturer shall be used in the Work. Particular attention shall be directed to compatibility of primers and finish coats.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by coating manufacturer.

B. Products:

Product	Definition
Acrylic Latex	Single-component, finish as required
Bituminous Paint	Single-component, coal-tar pitch based
Epoxy Primer—Ferrous Metal	Anticorrosive, converted epoxy primer containing rust-inhibitive pigments
Epoxy Primer—Other	Epoxy primer, high-build, as recommended by coating manufacturer for specific galvanized metal, copper, or nonferrous metal alloy to be coated
High Build Epoxy	Amine or novolac cured epoxy, minimum 69% volume solids, capability of 4 to 8 MDFT per coat, suitable for exposure to primary wastewater
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish

2.04 MIXING

A. Multiple-Component Coatings:

1. Prepare using each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Furnish small quantity kits for touchup painting and for painting other small areas.
5. Mix only components specified and furnished by paint manufacturer.
6. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

B. Colors: Formulate paints with colorants free of lead, lead compounds, or other materials that might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

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2.05 SHOP FINISHES

A. Shop Blast Cleaning: Reference Paragraph Shop Coating Requirements.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:

1. When required by equipment specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.
2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:

1. Ductile Iron Pipe:
   a. Use the NAPF 500-03 standards as a guide for desired prepared surface. Follow recommendations of pipe and coating manufacturers for means and methods to achieve the surface conditions specified in these standards.
   b. The surface preparation and application of the primer and finish coats shall be performed by pipe manufacturer.
   c. For high performance (epoxy) coatings, follow additional recommendations of pipe and coating manufacturers.
   d. Prior to blast cleaning, grind smooth surface imperfections, including, but not limited to delaminating metal or oxide layers.
2. Steel Pipe:
   a. Surface preparation and application of primer and finish coats shall be performed by pipe manufacturer.
   b. For pipe with epoxy lining, do not place end cap seals until pipe lining material has sufficiently dried.

PART 3 EXECUTION

3.01 GENERAL

A. Provide Engineer minimum 7 days' advance notice to start of field surface preparation work and coating application work.

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B. Perform the Work only in presence of Engineer, unless Engineer grants prior approval to perform the Work in Engineer's absence.

C. Schedule inspection of cleaned surfaces and all coats prior to succeeding coat in advance with Engineer.

3.02 EXAMINATION

A. Factory Finished Items:

1. Schedule inspection with Engineer before repairing damaged factory-finished items delivered to Site.
2. Repair abraded or otherwise damaged areas on factory-finished items as recommended by coating manufacturer. Carefully blend repaired areas into original finish. If required to match colors, provide full finish coat in field.

B. Surface Preparation Verification: Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. The more stringent requirements shall apply.

3.03 PROTECTION OF ITEMS NOT TO BE PAINTED

A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere to be painted.

B. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

C. Protect working parts of mechanical and electrical equipment from damage during surface preparation and painting process.

D. Mask openings in motors to prevent paint and other materials from entering.

E. Protect surfaces adjacent to or downwind of Work area from overspray.

3.04 SURFACE PREPARATION

A. Field Abrasive Blasting:

1. Perform blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed or coated.

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2. Refer to coating systems for degree of abrasive blasting required.
3. Where the specified degree of surface preparation differs from manufacturer's recommendations, the more stringent shall apply.

B. Steel Surface Preparation:

1. Where indicated, meet requirements of SSPC Specifications summarized below:
    a. SP 1, Solvent Cleaning: Removal of visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants by cleaning with solvent.
    b. SP 2, Hand Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using nonpower hand tools.
    c. SP 3, Power Tool Cleaning: Removal of loose rust, loose mill scale, loose paint, and other loose detrimental foreign matter, using power-assisted hand tools.
    d. SP 5, White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter by blast cleaning.
    e. SP 6, Commercial Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 33 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
    f. SP 7, Brush-Off Blast Cleaning: Removal of visible rust, oil, grease, soil, dust, loose mill scale, loose rust, and loose coatings. Tightly adherent mill scale, rust, and coating may remain on surface.
    g. SP 10, Near-White Metal Blast Cleaning: Removal of visible oil, grease, dust, dirt, mill scale, rust, coatings, oxides, corrosion products, and other foreign matter, except for random staining limited to no more than 5 percent of each unit area of surface which may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings.
    h. SP 11, Power Tool Cleaning to Bare Metal: Removal of visible oil, grease, dirt, dust, mill scale, rust, paint, oxide, corrosion products, and other foreign matter using power-assisted hand tools capable of producing suitable surface profile. Slight residues of rust and paint may be left in lower portion of pits if original surface is pitted.

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2. The words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” and “blast cleaning,” or similar words of equal intent in these Specifications or in paint manufacturer’s specification refer to the applicable SSPC Specification.
3. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Coating manufacturers’ recommendations for wet blast additives and first coat application shall apply.
4. Hand tool clean areas that cannot be cleaned by power tool cleaning.
5. Round or chamfer sharp edges and grind smooth burrs, jagged edges, and surface defects.
6. Welds and Adjacent Areas:
    a. Prepare such that there is:
        1) No undercutting or reverse ridges on weld bead.
        2) No weld spatter on or adjacent to weld or any area to be painted.
        3) No sharp peaks or ridges along weld bead.
    b. Grind embedded pieces of electrode or wire flush with adjacent surface of weld bead.
7. Pre-Blast Cleaning Requirements:
    a. Remove oil, grease, welding fluxes, and other surface contaminants prior to blast cleaning.
    b. Cleaning Methods: Steam, open flame, hot water, or cold water with appropriate detergent additives followed with clean water rinsing.
    c. Clean small isolated areas as above or solvent clean with suitable solvent and clean cloth.
8. Blast Cleaning Requirements:
    a. Type of Equipment and Speed of Travel: Design to obtain specified degree of cleanliness. Minimum surface preparation is as specified herein and takes precedence over coating manufacturer’s recommendations.
    b. Select type and size of abrasive to produce surface profile that meets coating manufacturer’s recommendations for particular primer to be used.
    c. Use only dry blast cleaning methods.
    d. Do not reuse abrasive, except for designed recyclable systems.
    e. Meet applicable federal, state, and local air pollution and environmental control regulations for blast cleaning, confined space entry (if required), and disposition of spent aggregate and debris.

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9. Post-Blast Cleaning and Other Cleaning Requirements:
    a. Clean surfaces of dust and residual particles from cleaning operations by dry (no oil or water vapor) air blast cleaning or other method prior to painting. Vacuum clean enclosed areas and other areas where dust settling is a problem and wipe with a tack cloth.
    b. Paint surfaces the same day they are blasted. Re-blast surfaces that have started to rust before they are painted.

C. Cast and Ductile Iron Metal Surface Preparation:

1. Provide ductile iron pipe to be painted without asphalt coating.
2. Grind smooth surface imperfections, including delaminating metal and annealing oxide that is not tightly adhered.
3. Remove oil, grease, and other surface contaminants in accordance with NAPF 500-03-01, Solvent Cleaning.
4. Abrasive blast clean in accordance with the following:
    a. Ductile Iron Pipe: NAPF 500-03-04.
    b. Cast Ductile Iron Fittings: NAPF 500-03-05.
    c. Exposed surfaces of metal at small coating defects may be prepared by Hand Tool Cleaning NAPF 500-03-02 or Power Tool Cleaning NAPF 500-03-03. Small coating defects are defined as a defect that exposes two square inches or less of bare metal.

D. Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation:

1. Remove soil, cement spatter, and other surface dirt with appropriate hand or power tools.
    a. In accordance with SSPC SP 16, Brush-Off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals.
    b. A brush-off blast cleaned non-ferrous metal surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, metal oxides (corrosion products), and other foreign matter.
    c. Intact, tightly adherent coating is permitted to remain. A coating is considered tightly adherent if it cannot be removed by lifting with a dull putty knife.
    d. Bare metal substrates shall have a minimum profile of 19 micrometers (0.75 mil).
2. Obtain and follow coating manufacturer’s recommendations for additional preparation that may be required.

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E. Concrete Surface Preparation:

1. Do not begin until 30 days after concrete has been placed.
2. Meet requirements of SSPC SP 13.
3. Remove grease, oil, dirt, salts or other chemicals, loose materials, or other foreign matter by solvent, detergent, or other suitable cleaning methods.
4. Brush-off blast clean to remove loose concrete and laitance, and to provide a tooth for binding. Upon approval by Engineer, surface may be cleaned by acid etching method. Approval is subject to producing desired profile equivalent to No. 80 grit flint sandpaper. Acid etching of vertical or overhead surfaces shall not be allowed.
5. Secure coating manufacturer's recommendations for additional preparation, if required, for excessive bug holes exposed after blasting.
6. Unless otherwise required for proper adhesion, ensure surfaces are dry prior to painting.

F. Plastic and FRP Surface Preparation:

1. Hand sand plastic surfaces to be coated with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

G. Existing Painted Surfaces to be Repainted Surface Preparation:

1. Provide the following for factory painted items that will be repainted in the field:
    a. Detergent wash and freshwater rinse.
    b. Clean loose, abraded, or damaged coatings to substrate by hand or power tool, SP 2 or SP 3.
    c. Feather surrounding intact coating.
    d. Apply one spot coat of specified primer to bare areas, overlapping prepared existing coating.
    e. Apply one full finish coat of specified primer to entire surface.
    f. If an aged, plural-component material is to be top coated, contact coating manufacturer for additional surface preparation requirements.
2. Application of Cosmetic Coat:
    a. It is assumed that existing coatings have oxidized sufficiently to prevent lifting or peeling when overcoated with paints specified.

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b. Check compatibility by application to a small area prior to starting painting.
c. If lifting or other problems occur, request disposition from Engineer.

3. Perform blasting as required to restore damaged surfaces. Materials, equipment, procedures shall meet requirements of SSPC.

H. Shop Primed Surfaces to be Field Finish Painted Surface Preparation:

1. Detergent wash and freshwater rinse.
2. Provide additional surface preparation as required for single component primers and converted epoxy primers that have not exceeded the manufacturer's published recoat windows.
3. For converted epoxy primers that will be exposed to nonimmersion service and that have exceeded the manufacturer's recoat window, abrade the surface by brush blasting or other manufacturer-approved method.
4. For converted epoxy primers that will be subject to immersion service, brush blast primer prior to application of finish coats if the recoat window has exceeded 30 days, or as recommended by the epoxy primer manufacturer.

3.05 SURFACE CLEANING

A. Brush-off Blast Cleaning:

1. Equipment, procedure, and degree of cleaning shall meet requirements of SSPC SP 7.
2. Abrasive: Either wet or dry blasting sand, grit, or nutshell.
3. Select various surface preparation parameters, such as size and hardness of abrasive, nozzle size, air pressure, and nozzle distance from surface such that surface is cleaned without pitting, chipping, or other damage.
4. Verify parameter selection by blast cleaning a trial area that will not be exposed to view.
5. Engineer will review acceptable trial blast cleaned area and use area as a representative sample of surface preparation.
6. Repair or replace surface damaged by blast cleaning.
   a. Rinse immediately to avoid formation on the surface of salts that are difficult to remove.
   b. Thoroughly rinse to remove any residual acid surface condition that may impair adhesion.
7. Ensure surface is completely dry before application of coating.

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B. Solvent Cleaning:

1. Consists of removal of foreign matter such as oil, grease, soil, drawing and cutting compounds, and any other surface contaminants by using solvents, emulsions, cleaning compounds, steam cleaning, or similar materials and methods that involve a solvent or cleaning action.
2. Meet requirements of SSPC SP 1.

3.06 APPLICATION

A. General:

1. The intention of these Specifications is for existing and new, interior, and exterior metal and submerged metal surfaces to be coated, whether specifically mentioned or not, except as specified otherwise. Plastic items in atmospheric exposures are intended to receive coatings. Do not paint exterior concrete surfaces, unless specifically indicated.
2. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.
3. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer’s written instructions for these requirements. Do not immerse coating until completion of curing cycle.
4. Apply coatings in accordance with these Specifications and paint manufacturers’ printed recommendations and special details. The more stringent requirements shall apply. Allow sufficient time between coats to assure thorough drying of previously applied paint.
5. Fusion Bonded Coatings Method Application: Electrostatic, fluidized bed, or flocking.
6. Coat units or surfaces to be bolted together or joined closely to structures or to one another prior to assembly or installation.
7. On pipelines, terminate coatings along pipe runs to 1 inch inside pipe penetrations.
8. Keep paint materials sealed when not in use.
9. Where more than one coat is applied within a given system, alternate colors to provide a visual reference showing required number of coats have been applied.

B. Galvanized Metal, Copper, and Nonferrous Metal Alloys:

1. Concealed galvanized, copper, and nonferrous metal alloy surfaces (behind building panels or walls) do not require painting, unless specifically indicated herein.

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2. Prepare surface and apply primer in accordance with System No. 10 specification.
3. Apply intermediate and finish coats of the coating system appropriate for the exposure.

C. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required without regard to coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Measure using a wet film thickness gauge to ensure proper coating thickness during application.
3. Film Thickness Measurements and Electrical Inspection of Coated Surfaces:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with specification.
   c. Coats are subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect metal and plastic surfaces to ensure proper and complete coverage has been attained.
5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thicknesses are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to achieve complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase the hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. Unless otherwise shown or specified, paint surfaces in accordance with the following application schedule. In the event of discrepancies or omissions in the following, request clarification from Engineer before starting work in question.

B. As shown on Drawings and on the Piping Schedule.

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C. System No. 2 Submerged Metal—Domestic Sewage:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 5, White Metal Blast Cleaning	Prime in accordance with manufacturer's recommendations	
	High Build Epoxy	2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Metal surfaces new and existing below a plane 1 foot above maximum liquid surface, metal surfaces above maximum liquid surface that are a part of immersed equipment, concrete embedded surfaces of metallic items, such as wall pipes, pipes, pipe sleeves, access manholes, gate guides and thimbles, and structural steel.
   b. Submerged and immersed cast iron, ductile iron, and steel, including but not limited to:
      1) Ductile iron valves.
      2) W5 ductile iron piping.
      3) Existing concrete encased metal pipe spools exposed during construction.
      4) When not specified elsewhere to be coated.
   c. As shown in other Specifications and on Drawings.

D. System No. 4 Exposed Metal—Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Metal Blast Cleaning	Epoxy Primer—Ferrous Metal	1 coat, 2.5 MDFT
	High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, new and existing, located inside or outside of structures and exposed to weather.
   b. Exposed cast iron, ductile iron, and steel, including but not limited to:
      1) Fabricated components, motors, gear reducers, and assemblies.
      2) Doors and frames.
      3) When not specified elsewhere to be coated.

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c. Exposed galvanized steel, after application of System No. 10 primer, requires Polyurethane Enamel only.
d. As shown in other Specifications and on Drawings.
e. Apply surface preparation and primer to surfaces prior to installation. Finish coats need only be applied to surfaces exposed after completion of construction unless installation will make the surface inaccessible.

E. System No. 7 Concrete Encased Metal:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 6, Commercial Blast Cleaning	High Build Epoxy	2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Use on concrete encased ferrous metals including wall pipes, pipe sleeves, access manholes, gate guides, and thimbles.

F. System No. 10 Galvanized Metal, Copper, and Nonferrous Metal Alloy Conditioning:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Galvanized Metal, Copper, and Nonferrous Metal Alloy Surface Preparation	Epoxy Primer—Other	As recommended by coating manufacturer Remaining coats as required for exposure

1. Use on the following items or areas:
   a. Galvanized surfaces requiring painting, including but not limited to: Outdoor exposed sheet metal flashing, trim, and fasteners.
   b. After application of System No. 10, apply finish coats as required for exposure.

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G. System No. 19a Concrete Exposed Metal Repair Coating—Wastewater:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush blast concrete in accordance with Paragraph Concrete Surface Preparation; blast exposed reinforcing steel to SP 10, Near-White Metal Blast Cleaning. See Note 1.	Amine-cured epoxy, suitable for exposure to primary wastewater, finish color gray.	2 coats, 8 MDFTPC, see Note 2.
Note 1. Surface Preparation Alternative: Mechanical abrade concrete surfaces to meet International Concrete Restoration Association standard 37/32, Concrete Surface Profile No. 3. Mechanically abrade exposed ends of reinforcing steel in accordance with SSPC SP 11, Power Tool Cleaning to Bare Metal. Note 2. Brush out surface voids and irregularities to provide a monolithic film.		

1. Use on the following items or areas:
   a. On saw-cut concrete surfaces that will not receive new concrete to cover exposed ends of rebar and metal embeds. Or alternately, where approved, over ends of and minimum two inches around ends of exposed metal and rebar in lieu of entire surface.

H. System No. 25 Exposed FRP, PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex (Semigloss)	2 coats, 320 SFPGPC

1. Use on the following items or areas:
   a. All exposed-to-view PVC and CPVC surfaces, and FRP surfaces without integral UV-resistant gel coat.

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I. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP 1)	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint	1 coat, 10 MDFT

1. Use on the following items or areas:
   a. Aluminum surfaces embedded or in contact with concrete.

3.08 COLORS

A. Provide as selected by Owner.

B. Proprietary identification of colors is for identification only. Selected manufacturer may supply matches.

C. Equipment Colors:

1. Equipment includes the machinery or vessel itself plus the structural supports and fasteners and attached electrical conduits.
2. Paint equipment and piping one color as selected.
3. Paint nonsubmerged portions of equipment the same color as the piping it serves, except as itemized below:
   a. Dangerous Parts of Equipment and Machinery: OSHA Orange.
   b. Fire Protection Equipment and Apparatus: OSHA Red.
   c. Radiation Hazards: OSHA Purple.
   d. Physical hazards in normal operating area and energy lockout devices, including, but not limited to, electrical disconnects for equipment and equipment isolation valves in air and liquid lines under pressure: OSHA Yellow.

D. Pipe Identification Painting:

1. Color code nonsubmerged metal piping, except electrical conduit. Paint fittings and valves the same color as pipe, except equipment isolation valves.
2. Pipe Color Coding: As selected by Owner.
3. On exposed stainless steel piping, apply color 24 inches in length along pipe axis at connections to equipment, valves, or branch fittings, at wall boundaries, and at intervals along piping not greater than 9 feet on center.
4. Pipe Supports: As selected by Owner.

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5. Fiberglass reinforced plastic (FRP) pipe, polyvinylidene fluoride (PVDF), and polyvinyl chloride (PVC) pipe located inside of buildings and enclosed structures will not require painting, except as noted or scheduled.

3.09 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide calibrated electronic type dry film thickness gauge to test coating thickness specified in mils.
2. Provide low-voltage wet sponge electrical holiday detector to test completed coating systems, 20 mils dry film thickness or less, except zinc primer, high-build elastomeric coatings, and galvanizing, for pinholes, holidays, and discontinuities. Unit as recommended by coating manufacturer.
3. Provide high-voltage spark tester to test completed coating systems in excess of 20 mils dry film thickness. Unit as recommended by coating manufacturer.

B. Testing:

1. Thickness and Continuity Testing:
   a. Measure coating thickness specified in mils with an electronic type, dry film thickness gauge, in accordance with SSPC PA 2. Check each coat for correct millage. Do not make measurement before a minimum of 8 hours after application of coating, or as recommended by the coating manufacturer.
   b. Test finished coating system on 100 percent of all submerged surfaces for holidays and discontinuities. All holidays and discontinuities shall be repaired to achieve a monolithic and pinhole free coating system:
      1) Holiday detect coatings 20 mils thick or less, except zinc primer and galvanizing, with low voltage wet sponge electrical holiday detector in accordance with NACE SP0188.
      2) Holiday detect coatings in excess of 20 mils dry with high voltage spark tester as recommended by coating manufacturer and in accordance with NACE SP0188.
   c. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final tests may also be conducted by Engineer.

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C. Inspection: Leave staging and lighting in place until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer. Provide additional staging and lighting as requested by Engineer.

D. Unsatisfactory Application:

1. If item has an improper finish color or insufficient film thickness, clean surface, and topcoat with specified paint material to obtain specified color and coverage. Obtain specific surface preparation information from coating manufacturer.
2. Evidence of runs, bridges, shiners, laps, or other imperfections is cause for rejection.
3. Repair defects in accordance with written recommendations of coating manufacturer.

E. Damaged Coatings, Pinholes, and Holidays:

1. All damaged coatings, pinholes, and holidays shall have the edges feathered and repaired in accordance with the recommendations of the manufacturer, to achieve pinhole free, monolithic coating systems. This also includes all damage that occurs to existing coatings during the Work.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather edges. Follow with primer and finish coat. Depending on extent of repair and appearance, a finish sanding and topcoat may be required.
3. Remove rust and contaminants from metal surface. Provide surface cleanliness and profile in accordance with surface preparation requirements for specified paint system.
4. Feather edges and repair in accordance with recommendations of paint manufacturer.
5. Apply finish coats, including touchup and damage-repair coats in a manner that will present a uniform texture and color-matched appearance.

3.10 MANUFACTURER'S SERVICES

A. In accordance with Section 01 43 33, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:

1. On first day of application of any coating system.
2. A minimum of two additional Site inspection visits, each for a minimum of 4 hours, in order to provide Manufacturer's Certificate of Proper Installation.

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3. As required to resolve field problems attributable to or associated with manufacturer's product.
4. To verify full cure of coating prior to coated surfaces being placed into immersion service.

3.11 CLEANUP

A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of the Work, remove staging, scaffolding, and containers from Site or destroy in a legal manner.

C. Remove paint spots, oil, or stains upon adjacent surfaces and floors and leave entire job clean.

3.12 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION

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PAINT SYSTEM DATA SHEET (PSDS)

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation (from Spec.):		
Paint Material (Generic)	**Product Name/Number (Proprietary)**	**Min. Coats, Coverage**

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PAINT PRODUCT DATA SHEET (PPDS)

Complete and attach manufacturer's Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning:_____

Ambient Temperature Limitations: min.:_____ max.:_____

Surface Temperature Limitations: min.:_____ max.:_____

Surface Profile Requirements: min.:_____ max.:_____

Attach additional sheets detailing manufacturer's recommended storage requirements and holiday testing procedures.

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SECTION 22 10 01
PLUMBING PIPING AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. American Public Works Association (APWA): Uniform Color Code.
3. American Society of Sanitary Engineering (ASSE): 1050, Performance Requirements for Stack Air Admittance Valves for Sanitary Drainage Systems.
4. ASTM International (ASTM):
   a. A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
   b. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   c. A74, Standard Specification for Cast Iron Soil Pipe and Fittings.
   d. A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications.
   e. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
   f. A563, Standard Specification for Carbon and Alloy Steel Nuts.
   g. A888, Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications.
   h. C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
   i. C1277, Standard Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
   j. C1460, Standard Specification for Shielded Transition Couplings for use with Dissimilar DWV Pipe and Fittings Above Ground.
   k. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
   l. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   m. D2000, Standard Classification System for Rubber Products in Automotive Applications.
   n. D2239, Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

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o. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
p. D2513, Standard Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings.
q. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
r. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
s. D2855, Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
t. D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
u. D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
v. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
w. E438, Standard Specification for Glasses in Laboratory Apparatus.
x. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
y. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
z. F1412, Standard Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage Systems.
aa. F1924, Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing.

5. American Water Works Association (AWWA):
   a. C104/A21.4, Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
   b. C110/A21.10, Standard for Ductile-Iron and Gray-Iron Fittings.
   c. C111/A21.11, Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   d. C115/A21.15, Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   e. C151/A21.51, Standard for Ductile-Iron Pipe, Centrifugally Cast.
   f. C207, Steel Pipe Flanges for Waterworks Service - Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
   g. C606, Grooved and Shouldered Joints.

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1.02 DESIGN REQUIREMENTS

A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

1. Building Service Piping: ASME B31.9, as applicable.
2. Local plumbing code.

1.03 SUBMITTALS

A. Action Submittals:

1. Product data sheets.
2. Shop Drawings: Show Contractor recommended changes in location of fixtures or equipment.
3. Isometric riser diagrams.

B. Informational Submittals:

1. Changes in location of equipment or piping that affect connecting or adjacent work, before proceeding with the work.
2. Complete list of products proposed for installation.
3. Test records produced during testing.
4. For Polyethylene (PE) Pipe:
    a. Certificates of qualification for persons to be fusing PE pipe.
    b. Experience and training record of persons to be fusing PE pipe.
    c. Testing Plan:
        1) Submit at least 15 days prior to testing; include following as a minimum:
            a) Testing dates.
            b) Piping systems and section(s) to be tested.
            c) Method of isolation.
            d) Method of conveying water from source to system being tested.
    d. Certifications of Calibration: Approved testing laboratory certificate if pressure gauge for hydrostatic test has been previously used. If pressure gauge is new, no certificate is required.
    e. Test report documentation.

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PART 2 PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 PIPING

A. Piping Schedule: Refer to Section 40 27 00, Process Piping—General.

B. Piping Material: Refer to Piping Data Sheet(s), Article Supplement and Section 40 27 00, Process Piping—General.

2.03 PIPE HANGERS AND SUPPORTS

A. Refer to Section 40 05 15, Piping Support Systems.

2.04 INSULATION

A. Pipe Insulation:

1. Type P4—Cellular Glass:
   a. Cellular glass, closed cell, rigid, nominal 8 pcf density, maximum K factor 0.33 at 75 degrees F mean, with factory-applied FSK (foil-scrim-kraft) vapor barrier jacket, for temperatures to 900 degrees F.
   b. Manufacturer and Product: Pittsburgh-Corning; Foamglas.

B. Insulation Finish System:

1. Type F1—PVC:
   a. Polyvinyl chloride (PVC) jacketing, white, for straight run piping and fitting locations, temperatures to 150 degrees F.
   b. Manufacturers and Products:
      1) Johns Manville; Zeston.
      2) Ceel-Co; 550.

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2.05 VALVES

A. Refer to Section 40 27 02, Process Valves and Operators.

2.06 MISCELLANEOUS PIPING SPECIALTIES

A. Insulating Dielectric Unions and Flanges:

1. Galvanically compatible with piping to which attached and pressure ratings suitable for system working pressures.
2. Unions 2 Inches and Smaller: Screwed or solder-joint type.
3. Unions 2-1/2 Inches and Larger: Flanged type, complete with bolt insulators, dielectric gasket, bolts, and nuts.
4. Manufacturers:
   a. Epco Sales, Inc., Cleveland, OH.
   b. Capitol Insulation Unions.

B. Rubber Gaskets: ASTM C564.

PART 3 EXECUTION

3.01 GENERAL

A. Install plumbing systems to meet applicable plumbing code.

B. Field Obstructions:

1. Drawings do not attempt to show exact details of piping. Provide offsets around obstructions.
2. Do not modify structural components, unless approved by Engineer.

C. Provide unions in piping systems at connections to equipment.

D. Provide shielded transition couplings, insulating dielectric unions and flanges between ferrous and nonferrous piping and where otherwise required for electrically insulated connection.

E. Pipe air release valves, water-lubricated bearings, and other appurtenances having water effluent with copper tubing to nearest drain.

3.02 INSTALLATION

A. Rigid PVC or CPVC:

1. Cut, make up, and install in accordance with pipe manufacturer’s recommendations.

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2. Ream, clean, and remove burrs from cut ends before joining pipe.
3. Lay in trench by snaking pipe from one side to other.
4. Offset: As recommended by manufacturer for maximum temperature variation between time of solvent welding and final use.
5. Do not lay pipe when temperature is below 40 degrees F or above 90 degrees F when exposed to direct sunlight.
6. Shield ends to be joined from direct sunlight prior to and during laying operation.
7. Use strap wrenches only for tightening threaded plastic joints. Do not over tighten fittings.

B. Polyethylene Piping:

1. Join pipes, fittings, and flange connections by means of thermal butt-fusion.
2. Perform butt-fusion in accordance with pipe manufacturer's recommendations as to equipment and technique.
3. Offset: As recommended by manufacturer for maximum temperature variation between time of solvent welding and during operation.
4. Do not lay pipe when temperature is below 40 degrees F or above 90 degrees F when exposed to direct sunlight.
5. Shield ends to be joined from direct sunlight prior to and during laying operation.
6. Joint Fusion:
    a. Measure and log each joint fusion by an electronic monitoring device (data logger) affixed to fusion machine capable of being retrieved electronically. Data to be logged shall include the following:
        1) Pipe size and dimensions.
        2) Machine model and size.
        3) Operator identification.
        4) Job identification number.
        5) Weld number.
        6) Fusion, heating, and drag pressure settings.
        7) Heater plate temperature.
        8) Time stamp showing when weld was performed.
        9) Heating and curing time of weld.
        10) Curing temperature readings and time stamps of readings.
        11) Error messages and warnings for out of range temperature or pressure settings.
    b. In addition to logged items above, the following shall be logged or annotated on report:
        1) Location of fused joint by pipeline station or by reference to pipe Shop Drawing.

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2) Ambient temperature and humidity.
3) If internal bead was removed.

C. Valves: Install in accordance with manufacturer's recommendations.

D. Miscellaneous Piping Specialties: Install in accordance with manufacturer's recommendations.

3.03 WASTE DRAINS AND VENTS PIPING

A. Installation:

1. Set piping above floor slab true and plumb.
2. Set exposed risers as close to walls as possible.
3. Slope drain lines at minimum 2 percent slope, unless otherwise noted. Vent lines shall be installed level or sloped, with no low spots.
4. Where vent stacks pass through roof slab, fit with flashing sleeve secured to roof.
5. Extend vents minimum 1 foot above roof.
6. Provide cleanouts where shown and where required by code.

3.04 HVAC CONDENSATE PIPING

A. Set piping true and plumb.

B. Slope piping 1/8 inch per foot minimum.

3.05 INSULATION

A. Insulate roof drain pipe 6 feet from roof drain.

B. Installation of Insulation:

1. Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices.
2. Apply insulation over clean, finish painted, and dry surfaces.
3. Install insulation after piping system has been pressure tested and leaks corrected.
4. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do not use cut pieces of scraps abutting each other.
5. Connection to Existing Piping: Cut back existing insulation to remove portion damaged by piping revisions. Install new insulation.

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6. Cold Surfaces: Provide continuous vapor seal on insulation on cold surfaces where vapor barrier jackets are used.
7. Insulation at Hangers and Supports: Install under piping, centered at each hanger or support.

C. Installation of Insulation Finish Systems:

1. Use a continuous friction type joint to hold jacket in-place, providing positive weatherproof seal over entire length of jacket.
2. Secure circumferential joints with preformed snap straps containing weatherproof sealant.
3. On exterior piping, apply coating over insulation and vapor barrier to prevent damage when aluminum fitting covers are installed.
4. Do not use screws or rivets to fasten the fitting covers.
5. Install removable prefabricated aluminum covers on exterior flanges and unions.
6. Caulk and seal exterior joints to make watertight.

3.06 HANGERS AND SUPPORTS

A. In accordance with Section 40 05 15, Piping Support Systems.

3.07 INTERIM CLEANING

A. As specified in Section 40 27 00, Process Piping—General.

B. Prevent accumulation of pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping during fabrication and assembly.

C. Examine piping to assure removal of foreign objects prior to assembly.

D. Conventional commercial cleaning methods of cleaning are acceptable if method and cleaning material does not corrode, deform, swell, or otherwise alter physical properties of material being cleaned.

3.08 TESTING

A. As specified in Section 40 80 01, Process Piping Leakage Testing.

3.09 CORROSION PROTECTION

A. As specified in Section 40 27 00, Process Piping—General.

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3.10 PROTECTION OF INSTALLED WORK

A. Protective Covers:

1. Provide over floor and shower drains during construction, to prevent damage to drain strainers and keep foreign material from entering drainage system.
2. Cover roof drains and emergency overflow drains during roofing process so roofing material and gravel do not enter drain piping.
3. Remove at time of Substantial Completion.

3.11 FIELD FINISHING

A. In accordance with Section 40 27 00, Processing Piping—General.

3.12 PIPING IDENTIFICATION

A. Refer to Section 40 27 00, Process Piping—General, and Pipe Schedule.

3.13 SUPPLEMENT

A. The supplement listed below, following "End of Section," is part of this specification.

1. Plumbing Piping Data Sheet.

Section Number	Title
22 10 01.02	Polyvinyl Chloride Drain Waste and Vent (PVC-DWV) Pipe and Fittings
22 10 01.08	High-Density Polyethylene (HDPE) Pipe and Fittings—Water and Sewer Service

END OF SECTION

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SECTION 22 10 01.02
POLYVINYL CHLORIDE
DRAIN WASTE AND VENT (PVC-DWV)
PIPE AND FITTINGS

Item	Size	Description
Pipe and Fittings	All	PVC-DWV Schedule 40 nonpressure application, Class 12454B conforming to ASTM D2665 and ANSI/NSF Standard 14 system.
Joints	All	Solvent cemented conforming to ASTM D2855 except where connection to equipment may require future removal.
Solvent Cement	All	As recommended by the pipe and fitting manufacturer conforming to ASTM D2564.

END OF SECTION

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SECTION 22 10 01.08
HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS—WATER AND SEWER SERVICE

Item	Size	Description
General	All	Pipe lengths, fittings, and flanged connections to be joined by thermal butt-fusion; shall be of the same type, grade, and class of polyethylene compound and supplied from same raw material supplier. Pipe tubing and fittings manufactured in accordance with ASTM D2239.
Pipe	1/2" to 4"	Cell class ASTM D3350 high-density polyethylene, maximum allowable hoop stress 1,600 psi at 73.4 degrees F. Polyethylene Resin: Conform to Type PE 4710 or better. Provide protection against ultraviolet light degradation using carbon black, not less than 2 percent, well dispersed in resin. Pipe wall thickness shall reflect required SDR* and diameter, as shown in Table 8, ASTM F714. For 3" and larger sizes, ASTM D3035. Design Stress Rating: 1,600 psi hydrostatic. Pressure Rating (psi) at 80 degrees F — SDR* 161 — 13.5 126 — 17.0 101 — 21.0 Identification: Colored stripes extruded into pipe outside surface for identification of type of service, in accordance with APWA Uniform Color Code. *SDR: standard dimension ratio = OD/thickness
Fittings	4" & smaller	Molded fittings, butt fusion joined, conforming to ASTM D3261.

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SECTION 22 10 01.08
HIGH-DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS—WATER AND SEWER SERVICE

Item	Size	Description
Flanges	All	Van Stone type, cast ASTM A351/A351M, Type 316 stainless steel backing ring, IPP Deltaflex convoluted design or equal for bolting to ANSI B16.1, Class 125; ANSI B16.5, Class 150; and AWWA C207, Class E. Pressure performance of backing ring equal to SDR rating of pipe with safety factor of two. Stub ends same grade HDPE and pressure rating as pipe.
Bolting		Stainless steel, ASTM A193/A193M Grade B8M studs and ASTM A194/A194M Grade 8M hex head nuts. Washers shall be same material as bolts.
Gaskets		Flat ring, 1/8" ethylene propylene rubber (EPR).
Manufacturer		JM Eagle PE 3408; Driscoplex 4000/4100 PE 3408.

END OF SECTION

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SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air Moving and Conditioning Association, Inc. (AMCA): 203, Field Performance Measurement of Fan Systems.
2. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE): HVAC Applications Handbook.
3. Associated Air Balance Council (AABC): National Standards for Field Management and Instrumentation Total System Balance.
4. National Environmental Balancing Bureau (NEBB):
   a. Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
   b. Procedural Standards for Measuring Sound and Vibration.
5. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): HVAC Testing, Adjusting, and Balancing Manual.

1.02 SUBMITTALS

A. Informational Submittals:

1. Documentation of experience record of testing authority.
2. Documentation of current AABC or NEBB certifications for those technicians in responsible charge of the work under this Contract.
3. Submit detailed test and balance procedures, including test conditions for systems to be tested, prior to beginning the Work.
4. Written verification of calibration of testing and balancing equipment.
5. Balancing Log Report following completion of system adjustments including test results, adjustments, and rebalancing procedures.

1.03 QUALITY ASSURANCE

A. Air Balancing and Test Agency Qualifications:

1. Certification by AABC of NEBB for testing, adjusting and balancing of HVAC systems.
2. Corporately and financially independent organization functioning as an unbiased testing authority.

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3. Professionally independent of manufacturers, suppliers, and installers of HVAC equipment being tested.
4. Have a proven record of at least five similar projects.
5. Employer of engineers and technicians regularly engaged in testing, adjusting and balancing of HVAC equipment and systems.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials, tools, test equipment, computers and instrumentation required to complete the work included.

B. Test Hole Plugs: Plug test holes in ducts with plugs made for that purpose and replace any insulation removed to specified conditions.

C. Drives for Belt-Driven Fans:

1. Furnish cast iron or flanged steel sheaves.
2. Sheaves and belt combination shall be capable of providing 150 percent of motor horsepower.

PART 3 EXECUTION

3.01 GENERAL

A. Adjust and balance air and water systems in accordance with standard procedures and recognized practices of the AABC or SMACNA.

B. Adjust and balance the following systems:

1. Supply, return and exhaust air systems.
2. Heating, cooling systems.

3.02 ADJUSTING AND BALANCING AIR SIDE

A. Preparation:

1. Prior to beginning the Work, perform the following activities:
   a. Review shop drawings and installed system for adequate and accessible balancing devices and test points.
   b. Recommend to Engineer dampers that need to be added or replaced in order to obtain proper air control.
   c. Verify proper startup procedures have been completed on the system.

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d. Verify controls installation is complete and system is in stable operation under automatic control.
e. Verify test instruments have been calibrated to a recognized standard and are within manufacturer's recommended calibration interval before beginning the Work.

B. General:

1. When adjustments are made to a portion of a fan system, reread other portions of that same system to determine effects imposed by adjustments. Readjust as necessary.
2. Lock and mark final positions of balancing dampers with permanent felt pen.

C. Equipment Data:

1. Collect the following data and included in final report:
   a. Type of unit.
   b. Equipment identification number.
   c. Equipment nameplate data (including manufacturer, model, size, type, and serial number).
   d. Motor data (frame, hp, volts, FLA rpm, and service factor).
   e. Sheave manufacturer, size, and bore.
   f. Belt size and number.
   g. Sheave centerline distance and adjustment limits.
   h. Starter and motor overload protection data.
   i. Include changes made during course of system balancing.

D. Fan Systems:

1. Measure fan system performance in accordance with AMCA 203.
2. In each system at least one airpath from fan to final branch duct termination shall have dampers fully open. Achieve final air quantities by adjusting fan speed.
3. Adjust Fan Air Volumes:
   a. Adjust fan speeds and motor drives for required equipment air volumes, with allowable variation of plus 10 percent minus 0 percent.
   b. After final adjustments, do not operate motor above nameplate amperage on any phase.
   c. After final adjustments, do not operate fan above maximum rated speed.

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d. Perform airflow test readings under simulated or actual conditions of full cooling, full heating, minimum outside air, full outside air and exhaust, and full return air.
e. Provide and make drive and belt changes on motors or fans as required to adjust equipment to specified conditions. Drives shall be able to deliver 150 percent of motor horsepower. Provide written notice to air handling unit manufacturer and Owner's representative if drive or belt changes were made.

4. Adjust outside air dampers, return air dampers, relief air dampers, exhaust air dampers, and motorized louvers for maximum and minimum air requirements.
5. Read and record static pressures at unit inlet and discharge, each filter set, coils, dampers, plenums, and mixing dual-duct or adjustable-volume boxes, on every supply, return, and exhaust fan for each test condition.
6. Read and record motor amperage on all phases for each test condition.

E. Air Terminal Devices:

1. Terminal Airflow Calibration: Calibrate and set the flow coefficients in terminal controller units to ensure controller readings are identical to measured values. This shall be a one-point calibration at maximum flow conditions. Record coefficient values.
2. Test each terminal flow device at minimum and maximum flow conditions. Ensure terminal controller is under control at time of each test.
3. If airflow of terminal device is derived from two or more flow streams, the individual air streams shall be measured and recorded independently for each test.
4. In each terminal system at least one airpath from terminal to final duct termination shall have dampers fully open.
5. Adjust air volumes on each terminal to quantity shown, with allowable variation of plus 10 percent minus 5 percent.

F. Air Outlets and Inlets:

1. In each system at least one air path from fan to final branch duct termination shall have dampers fully open.
2. Adjust air volumes on supply diffusers and grilles, and on return and exhaust grilles, to the quantity shown, with allowable variation of plus or minus 10 percent.
3. Adjust diffusers and grilles for proper deflection, throw, and coverage. Eliminate drafts and noise where possible.
4. After final adjustments are made secure dampers to prevent movement and mark final positions with permanent felt pen.

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G. Building Static Pressure:

1. Measure building static pressure relative to outside in perimeter entrances during normal system conditions that would yield widest range in internal building pressure.
2. Adjust building static pressure control parameters to ensure perimeter entrances are positive or negative to outdoors as indicated on the air flow schematics with entrance and connecting doors closed.
3. For multi-story buildings, test pressure conditions at ground, intermediate, and upper levels.

H. Zone Differential Pressure:

1. Test and adjust indicated differential pressures by setting design flows to meet required flow direction and pressure differential during worst case conditions of systems serving zone being adjusted and of adjacent zones.
2. Provide written notice to Engineer of zone leakage conditions preventing design differential requirements to be met.

3.03 ADJUSTING AND BALANCING WATER SIDE

A. Preparation:

1. Prior to beginning the Work, perform the following activities:
   a. Review shop drawings and installed system for adequate and accessible balancing devices and test ports.
   b. Recommend to Engineer devices needed to be added or replaced in order to obtain proper water control.
   c. Verify proper startup procedures have been completed on system.
   d. Verify controls installation is complete and system is in stable operation under automatic control.
   e. Verify hydronic systems have been filled and are clean. Examine a sample of strainers to ensure cleanliness.
   f. Verify manual air vents have been bled and expansion tanks and automatic air vents are functioning.
   g. Verify control valves and coil connections are complete and properly installed.

B. General:

1. When adjustments are made to a portion of a water system, reread other portions of that same system to determine effects imposed by adjustments. Readjust as necessary.
2. Correctly adjust water flow readings for mixtures other than pure water.

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3. Throttling of butterfly and other nonbalancing device valves shall not be allowed.
4. Lock and mark final positions of balancing devices with a centerpunch or permanent felt pen.

C. Equipment Data:

1. Collect the following data and include in final report:
   a. Type of pump.
   b. Equipment identification number.
   c. Equipment nameplate data (including manufacturer, model, size, type, impeller size and serial number).
   d. Pump capacity (flow rate and differential pressure).
   e. Drive data.
   f. Motor data (frame, hp, volts, FLA rpm, and service factor).
   g. Starter and motor overload protection data.
   h. Include changes made during course of system balancing.

D. Pumps:

1. Verify impeller size through a “dead-head” test. Do not perform on positive displacement pumps.
2. Adjust water to achieve design flows at all modes of operation during single and multiple pump operation.
3. Test redundant and stand-by pumps.
4. After final adjustments, do not operate motor above nameplate amperage on any phase.
5. Read and record pressures at pump inlet and discharge for each test condition.
6. Read and record motor amperage on all phases for each test condition.
7. Record and mark final position of balancing cocks, valves, and operators with a permanent felt pen or centerpunch.

E. Terminal Flow Devices:

1. Adjust water systems for required flow rates at each coil, connection, and terminal device.
2. Provide proper flow through individual fin tube sections, evaporator and condenser circuits, each boiler loop, each pump, and recirculation loops.
3. Measure and adjust flow through valves and valve bypass lines.
4. Record and mark final position of balancing cocks, valves, and operators with a permanent felt pen or centerpunch.
5. Read and record differential pressures across coils, control valves, chiller bundles, boilers, and heat exchanges.

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F. Tolerances:

1. Heating Water Flow Rate: Plus 10 percent to minus 10 percent.
2. Chilled Water Flow Rate: Plus 10 percent to minus 0 percent.
3. Condenser Water Flow Rate: Plus 10 percent to minus 10 percent.

3.04 FIELD QUALITY CONTROL

A. General: Perform functional tests as required by Section 01 91 14, Equipment Testing and Facility Startup.

B. Performance Testing:

1. Electric Heating Coil Testing:
   a. Adjust system as required to achieve full output from coil.
   b. Read and record amperages and voltages for all phases.
2. Heating or Sensible Cooling Coil Testing:
   a. Adjust system as required to achieve design flow conditions for both air and water sides of coil.
   b. Measure and record airflow rate, water flow rate, entering air temperature, entering water temperature, leaving air temperature and leaving water temperature.
3. Packaged Equipment Heating Cooling Coil Testing:
   a. Adjust system as required to achieve design flow conditions for air and side of coil.
   b. Measure and record airflow rate, entering air dry bulb and wet bulb temperatures, leaving air dry bulb and wet bulb temperatures.
4. Vibration Testing:
   a. Upon completion of air and water system balance, perform vibration testing as specified below for the following rotating or reciprocating equipment:
      1) Primary Clarifier Building Supply Fan (210-SF-2101).
      2) Primary Clarifier Building Supply Fan (210-SF-2102).
   b. Test Procedures:
      1) Identify maximum vibration velocity limits as specified for each piece of equipment to be tested.
      2) Take measurements at each bearing housing using calibrated electronic analyzer.
      3) Measure velocity in direction parallel to rotating shaft, and in two directions perpendicular to shaft and to each other. Align measurement directions where possible to the horizontal and vertical planes.

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4) Record log shall include equipment symbol or tag, location, identification, specified vibration velocity limits, and maximum measured velocity in each direction.
5) Notify Engineer if amplitude exceeds upper limit specified.

C. Balancing Log Report Requirements:

1. Include narrative description for each system explaining TAB methodology and assumptions used. Clearly identify test conditions for tests performed. Include control setpoint.
2. Log and record operational information from every test for each system, as necessary to accomplish services described.
3. Include equipment data for units tested.
4. Include reduced set of HVAC Drawings or system schematic diagrams with each element uniquely identified and indexed to balance log.
5. Indicate recorded site values, and velocity and mass correction factors used to provide equivalent standard air quantities.
6. Include separate section in log, if necessary, describing operating difficulties in air or water systems that could not be eliminated by specified procedures. Identify these problems by system and location within building; include outline or summary of condition and its effect on building, and describe corrective actions attempted and recommended.

D. Quality Control Verification:

1. After adjustments have been completed and balance logs submitted, balancing and testing agency shall be available to demonstrate the following:
   a. Air and water balancing procedures, vibration tests, and verification of test results.
   b. Perform spot tests on a maximum of 20 percent of total diffusers and grilles, on two air handling fan devices per building, and on 10 percent of total water balance fittings, with measuring equipment used in original tests, at random points selected by Engineer.
   c. Results of these spot tests shall agree with balance logs within plus or minus 10 percent. Where this accuracy cannot be verified, rebalance portions of system as requested by Engineer.
   d. At completion of rebalance procedures, perform another spot test if required to verify results.

END OF SECTION

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SECTION 23 31 13
METAL DUCTS AND ACCESSORIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air Movement and Control Association (AMCA): 500, Test Methods for Louvers, Dampers and Shutters.
2. American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Handbook.
3. American Society of Mechanical Engineers (ASME): A13.1, Scheme for the Identification of Piping Systems.
4. Association of the Nonwoven Fabrics Industry (INDA): IST 80.6, Water Resistance (Hydrostatic Pressure).
5. ASTM International (ASTM):
    a. A36/A36M, Standard Specification for Carbon Structural Steel.
    b. A90/A90M, Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
    c. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
    d. A176, Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip.
    e. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
    f. A480/A480M, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
    g. A568/A568M, Standard Specification for Steel, Sheet, Carbon, Structural, and High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, General Requirements for.
    h. A653/A653M, Standard Specifications for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
    i. A700, Standard Practices for Packaging, Marking, and Loading Methods for Steel Products for Shipment.
    j. A924/A924M, Specification for General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process.

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k. A1008/A1008M, Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
l. 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.
m. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

6. National Air Duct Cleaners Association (NADCA): General Specifications for the Cleaning of Commercial Heating, Ventilation and Air Conditioning Systems.
7. National Fire Protection Association (NFPA):
   a. 90A, Standard for the Installation of Air-Conditioning and Ventilating Systems.
   b. 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
   c. 255, Standard Method of Test of Surface Burning Characteristics of Building Materials.
   d. 259, Standard Test Method for Potential Heat of Building Materials.
   e. 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.
8. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   a. Duct Construction Standards.
   b. Guidelines for Seismic Restraints of Mechanical Systems.
   c. Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems.
9. UL:
   a. 181, Standard for Safety Factory-Made Air Ducts and Connectors.
   b. 214, Standard for Tests for Flame-Propagation of Fabrics and Films.
   c. 555, Standard for Safety Fire Dampers.
   d. 555S, Standard for Safety Smoke Dampers.

1.02 DEFINITIONS

A. The following is a list of abbreviations which may be used in this section:

1. cfm: Cubic feet per minute.
2. fpm: Feet per minute.

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3. pcf: Pounds per cubic foot.
4. WC: Water column.

B. Sealing Requirements:

1. For the purpose of duct systems sealing requirements specified in this section, the following definitions apply:
   a. Seams: Joining of two longitudinally (in direction of airflow) oriented edges of duct surface material occurring between two joints. All other duct surface connections made on perimeter are deemed to be joints.
   b. Joints, duct surface connections including:
      1) Girth joints.
      2) Branch and subbranch intersections.
      3) Duct collar tap-ins.
      4) Fitting subsections.
      5) Louver and air terminal connections to ducts.
      6) Access door, and access panel frames and jambs.
      7) Duct, plenum, and casing abutments to building structures.

1.03 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Rectangular and Rigid Round Ductwork:
      1) Schedules of duct systems, materials, joints, sealing, gauge, and reinforcement.
      2) SMACNA Figure Numbers for each shop fabricated item.
      3) Reinforcing details and spacing.
      4) Seam and joint construction details.
      5) Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
   b. Ductwork Accessories:
      1) Manufacturer’s product data including catalog sheets, diagrams, standard schematic drawings, installation instructions and details, details of materials, construction, dimensions of individual components, and finishes, including the following items:
         a) Fittings and volume control damper installation (both manual and automatic) details.
         b) Duct liner.
         c) Sealing materials.

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d) Dampers; include leakage, pressure drop, and maximum back pressure data.
e) Duct-mounted access panels and doors.
f) Flexible ducts.
g) Sheet metal fasteners.

2. Duct Fabrication Drawings:
   a. Drawn after actual job measurements are obtained.
   b. Drawn to a scale not smaller than 1/4 inch equals 1 foot, on drawing sheets same size as Contract Drawings.
   c. Include the following features:
      1) Fabrication, assembly, and installation details including plans, elevations, sections, details of components, and attachments to other work.
      2) Duct layout, indicating pressure classifications, and sizes in plan view.
      3) Duct material and thickness.
      4) Fittings and volume control damper installation (both manual and automatic) details.
      5) Reinforcing details and spacing.
      6) Seam and joint construction details.
      7) Penetrations through fire-rated and other partitions.
      8) Duct accessories and control devices such as automatic dampers, airflow monitors, terminal units, smoke detectors, regulators, air distribution devices, etc.
      9) Hangers and supports, including methods for building attachment, vibration isolation, and duct attachment.
      10) Fire and smoke damper installations, including sleeves and duct-mounted access door and panel installation.
      11) Coordination with ceiling suspension members.
      12) Spatial coordination with other systems installed in same space with duct systems.
      13) Coordination of ceiling- and wall-mounted access doors and panels required for access to dampers and other operating devices.
      14) Coordination with ceiling-mounted lighting fixtures, air outlets, and inlets.
      15) Coordination of ductwork with sprinkler piping and other mechanical and electrical services, and equipment.
3. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.

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B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.
3. Record Drawings: Include duct systems routing, fittings details, and installed accessories and devices.

1.04 QUALITY ASSURANCE

A. Industry Standards:

1. Unless otherwise indicated or specified, sheet metal ductwork shall be constructed and installed in accordance with SMACNA Duct Construction Standards relevant to ductwork system being provided. These standards are herein referenced as the SMACNA Manual, unless otherwise indicated.
2. Comply with ASHRAE Fundamentals Handbook recommendations, except as otherwise indicated.
3. NFPA Compliance: NFPA 90A and NFPA 90B.

B. Manufacturers: Firms regularly engaged in manufacture of ductwork products of types, materials, and sizes required, whose products have been satisfactorily used in similar service for not less than 5 years.

C. Suppliers of duct and fitting components shall provide on request the following information:

1. Laboratory performance data for duct, including leakage rate, bursting strength, collapse strength, seam strength, and pressure loss.
2. Laboratory performance data for fittings, including zero-length dynamic losses.

D. Installer shall be a firm with at least 3 years' experience of successful installation on ductwork systems similar to that required for this Project.

E. Changes or alterations to layout or configuration of duct system shall be:

1. Specifically approved in writing by Engineer.
2. Proposed layout shall provide original design results, without increasing system total pressure.

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1.05 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following:

Item	Quantity
Fusible Links	10 percent of amount installed
Special tools required to maintain or dismantle	2 complete sets

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect ductwork from dirt, water, and debris. During storage on Job Site, keep ends of ductwork covered to prevent foreign objects and water from entering ductwork.

B. If fabricated sound-lined ductwork gets wet during installation, remove, and dispose of ductwork from the Site.

C. Deliver sealant materials to Site in original unopened containers labeled with manufacturer, product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions for multi-component materials.

D. Store and handle sealant materials in compliance with manufacturers' recommendations to prevent deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

E. Deliver and store stainless steel sheets with mill-applied adhesive protective paper, maintained through fabrication and installation.

PART 2 PRODUCTS

2.01 GENERAL

A. Specified components of this ductwork system, including facings, mastics, and adhesives, shall have fire hazard rating not to exceed 25 for flame spread without evidence of continued progressive combustion, and 50 for smoke developed, as per test conducted in accordance with ASTM E84 and NFPA 255 methods.

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B. Internally Lined Ductwork: Duct sizes indicated for internally lined ducts are the clear inside dimensions, and shall be increased in both dimensions by twice the thickness of the liner.

C. Ductwork Interior Surfaces:

1. Smooth.
2. No sheet metal parts, tabs, angles, or other items may project into air ducts, unless otherwise specified.
3. Seams and joints shall be external.
4. For ductwork that is required to be reinforced, use only external reinforcing.

2.02 SHEET METAL MATERIALS

A. Construct metal duct systems from aluminum except where indicated otherwise. Where indicated as steel, ductwork shall be G90 galvanized.

B. Aluminum Ductwork:

1. Comply with ASTM B209.
2. Aluminum Sheet: Alloy 5005-H14, unless indicated otherwise.
3. Aluminum Connectors and Bar Stock: Alloy 6061-T6 or equivalent.

C. Exposed Ductwork: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, oil canning, stains, discoloration, and other imperfections, including those which would impair painting.

D. Reinforcement Shapes and Plates: Unless otherwise indicated, provide reinforcements of same material as ductwork.

2.03 DUCT SEALING MATERIALS

A. General: The term sealant used here is not limited to materials of adhesive or mastic nature, but also includes tapes and combinations of open weave fabric strips and mastics.

B. Adhesives, Cements, Sealant, and Installation Accessories: As recommended by duct manufacturer for application.

C. Water-Based Sealants:

1. Listed by manufacturer as nonflammable in wet and dry state.

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2. Manufacturers and Products:
   a. Foster; Series 32.
   b. Childers; CP-145A, 146.
   c. Rectorseal; Airlok 181.

2.04 DUCTWORK FASTENERS

A. General:

1. Rivets, bolts, or sheet metal screws.
2. Ductwork fasteners shall be same metal as duct being supported, unless otherwise noted.

B. Self-Drilling Screws:

1. Galvanized Steel Ductwork System: Sheet metal screws shall be hex washer head (HWH) TEKS® self-drilling type, formed from heat-treated carbon steel with zinc electroplated finish.
2. Aluminum Ductwork System:
   a. Sheet metal screws shall be hex washer head (HWH) TEKS® self-drilling type, formed from heat-treated Marutex® stainless steel with strength of Type 410 stainless steel and corrosion resistance of Type 304 stainless steel, complete with bonded metal and fiber washer for dielectric separation.
   b. Manufacturers:
      1) DB Building Fasteners Inc., Santa Fe Springs, CA.
      2) Clark Craft Fasteners, Tonawanda, NY.

2.05 DUCTWORK PRESSURE CLASS

A. Construct duct systems to pressure classifications indicated:

1. Supply Ducts: 3-inch WC.
2. Return Ducts: 2-inch WC, negative pressure.
3. Exhaust Ducts: 2-inch WC, negative pressure.

B. Where no specific duct pressure designations are indicated in Specifications or on Drawings, 2-inch WC pressure class shall be basis of Contract.

2.06 RECTANGULAR DUCTWORK

A. Fabricate rectangular ducts in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible.

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B. Crossbreaking or Cross Beading: Crossbreak or bead duct sides that are 19 inches and larger and are 20-gauge or less, with more than 10 square feet of unbraced panel area, as indicated in SMACNA Manual, unless they are lined or are externally insulated.

C. Air Handling Unit Discharge Ductwork: Ductwork extending from air handling units up to and including first elbow or terminal tap outside air handling unit room shall be constructed 16-gauge, minimum sheet metal, same material as remainder of system.

2.07 RECTANGULAR DUCTWORK FITTINGS

A. Fabricate elbows, transitions, offsets, branch connections, and other duct construction in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible.

B. Elbows:

1. Fit square-turn elbows with vane side rails.
2. Shop fabricate double-blade turning vanes of same material as ductwork.
3. Fabricate with equal inlet and outlet.
4. Rectangular radius elbows with inside radius of 3/4 of duct width in direction of turn.
5. Manufacturers and Products:
   a. Elgen; All-Tight.
   b. Duro-Dyne; Type TR.

2.08 RECTANGULAR DUCTWORK BRANCH CONNECTIONS

A. Branch duct connections to rectangular duct mains shall be made using factory fabricated fittings with spot welded tap to main duct connections or with factory fabricated, field installed taps, with spin-in or mechanical fastened tap to main duct connections.

2.09 RECTANGULAR DUCTWORK INSULATION LINER

A. Location: Provide ductwork with internal insulation liner where indicated on Drawings or in Ductwork Schedule.

B. Material:

1. Fiberglass, nominal 1-inch thick unless indicated otherwise indicated, 1.5 pcf density liner, K factor 0.25 maximum at 75 degrees F mean.

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2. Black composite coating on surface exposed to airstream to prevent erosion of glass fibers, for temperatures to 250 degrees F.
3. Liquid water repellency rating not less than 4.0 when tested in accordance with INDA IST 80.6.
4. Potential heat value not exceeding 3,500 Btu per hour per pound when tested in accordance with NFPA 259 and meeting classification of "Limited Combustible" as defined by NFPA 90A.
5. Maximum rated velocity not less than 6,000 fpm when tested in accordance with ASTM C1071.
6. Resistant to microbial growth using a "no growth criteria" when tested in accordance with ASTM C1139.
7. Manufacturers and Products:
   a. CertainTeed; Toughgard.
   b. JohnsManville; Linacoustic RC.
   c. Knauf; Duct Liner M.

C. Liner Adhesive: In accordance with NFPA 90A and ASTM C916.

D. Mechanical Fasteners:

1. Same material as ductwork, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct.
2. Provide fasteners that do not damage liner when applied as recommended by manufacturer, that do not cause leakage in duct, and will indefinitely sustain 50-pound tensile dead load test perpendicular to duct wall.
3. Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
4. Adhesive for Attachment of Mechanical Fasteners: In accordance with Fire Hazard Classification of duct liner system.

E. Liner Application:

1. Ductwork liner shall be applied at time of ductwork manufacture in an approved sheet metal workshop.
2. Adhere single layer of indicated thickness of duct liner with 90 percent coverage of adhesive at liner contact surface area. Multiple layers of insulation to achieve indicated thickness is prohibited.
3. Apply coat of adhesive to liner facing in direction of airflow not receiving metal nosing.
4. Butt transverse joints without gaps and coat joint with adhesive.
5. Fold and compress liner in corners of rectangular ducts or cut and fit to assure butted edge overlapping.

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6. Longitudinal Joints:
   a. Shall not occur except at corners of ducts, unless size of duct and standard liner product dimensions make longitudinal joints necessary.
   b. Apply adhesive coating on longitudinal seams in ducts exceeding 2,500 fpm air velocity.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely around perimeter, at 3 inches from transverse joints, and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing airstream with metal nosing that are either channel or "Z" profile or are integrally formed from duct wall at the following locations:
   a. Fan discharge.
   b. Intervals of lined duct preceding unlined duct.
   c. Upstream edges of transverse joints in ducts.
9. Seal insulation edges.
10. Repair abrasions or tears with mastic.

2.10 RIGID ROUND DUCTWORK

A. Construct rigid round ducts in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, unless specified otherwise.

B. Basic Round Diameter: As used in this Article, is inside diameter of size of round duct.

C. Where space limitations prevent use of round duct or where shown on Drawings, provide ductwork of flat oval construction hydraulically equivalent to round ductwork.

D. Fabricate round ducts with spiral seam construction, except where diameters exceed 72 inches. Fabricate ducts having diameters greater than 72 inches with longitudinal butt-welded seams.

E. Ductwork seams of Snaplock type shall not be used.

2.11 RIGID ROUND DUCTWORK FITTINGS

A. Construct rigid round ductwork fittings in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, unless otherwise specified.

B. 90-Degree Tees, Laterals, and Conical Tees: Fabricate to conform to SMACNA manual with metal thicknesses specified for longitudinal seam straight duct.

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C. Diverging Flow Fittings: Fabricate with a reduced entrance to branch taps with no excess material projecting from body onto branch tap entrance.

D. Elbows:

1. Fabricate in stamped (die-formed), pleated, or segmented (gored) construction 1.5 times elbow diameter. Two piece segment elbows are not allowed, except with turning vanes.
2. Segmented Elbows: Fabricate with welded construction.
3. Round Elbows 8 Inches and Smaller:
   a. Stamped elbows for 45-degree and 90-degree elbows and pleated elbows for 30 degrees, 45 degrees, 60 degrees, and 90 degrees configuration.
   b. Fabricate nonstandard bend angle configurations or nonstandard sized (for example, 3-1/2 inches and 4-1/2 inches) elbows with segmented construction.
4. Round Elbows 9 Inches through 14 Inches:
   a. Segmented or pleated elbows for 30 degrees, 45 degrees, 60 degrees, and 90 degrees.
   b. Fabricate nonstandard bend angle configurations or nonstandard sized (for example, 9-1/2 inches and 10-1/2 inches) elbows with segmented construction.

2.12 INSULATED FLEXIBLE DUCT

A. Fabricate in accordance with:

1. UL 181, Class 1.
2. NFPA 90A and NFPA 90B.

B. Construction:

1. Outer Jacket: Fire retardant reinforced metalized vapor barrier jacket with reinforced cross-hatched scrim having a permeance of not greater than 0.1 perm when tested in accordance with ASTM E96/E96M, Procedure A.
2. Inner Liner: Tri-laminate of aluminum foil, fiberglass, and aluminized polyester.
3. Reinforcing: Galvanized steel wire helix, mechanically locked to and encapsulated by inner liner fabric.
4. Insulation:
   a. Factory insulated with fiberglass insulation.
   b. R-value: 6.0 minimum at a mean temperature of 75 degrees F.

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5. Internal Working Pressure: Rating shall be minimum 4-inch WC positive and 5-inch WC negative, with bursting pressure of at least 2-1/2 times working pressure.
6. Air Velocity Rating: 4,000 fpm, minimum.

C. Environment: Suitable for continuous operation at temperature range of minus 20 degrees F to plus 200 degrees F.

D. Manufacturers and Products:

1. Flex-Master; Type 5M.
2. Thermaflex; Type M-KC.
3. Hart & Cooley; Type F216.

2.13 DUCTWORK HANGERS AND SUPPORTS

A. General:

1. Attachments, hangers, and supports for ductwork shall be in accordance with SMACNA Manual referenced for type of duct system being installed.
2. Duct hanging system shall be composed of four elements; upper attachment to building, hanger itself, bracing, and lower attachment to duct.
3. Wire hangers are not acceptable.
4. Hanger Spacing:
   a. Ducts Up to 60 inches in Largest Dimension: 10 feet, maximum.
   b. Ducts Over 61 inches in Largest Dimension: 8 feet, maximum.

B. Construction Materials:

1. Supporting devices including, but not limited to, angles used for support and bracing, baseplates, rods, hangers, straps, screws, bolts shall be as follows:
   a. Aluminum Ductwork Indoors and Outdoors:
      1) Carbon steel, hot-dipped galvanized after fabrication.
      2) Nonmetallic pad between lower attachment and ductwork, to achieve dielectric separation.

C. Building Attachments:

1. Anchor bolts shall be in accordance with Section 05 05 19, Post-Installed Anchors.

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2. Upper Attachment (Concrete):
   a. Threaded stud fastener may be used for ducts up to 36-inch maximum dimension.
   b. Concrete attachments shall be made of steel.

D. Duct Fasteners: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials and conforming to requirements of Article Ductwork Fasteners.

E. Trapeze and Riser Supports: Steel shapes conforming to ASTM A36/A36M, hot-dipped galvanized after fabrication.

2.14 DUCTWORK FLEXIBLE CONNECTIONS

A. General:

1. Factory fabricated metal-edged fabric flexible connectors for commercial or industrial applications.
2. Sheet metal permanently secured to fabric with double fabric fold, double metal crimp.
3. Comply with NFPA 90A and NFPA 90B requirements.
4. Airtight and waterproof.

B. Materials:

1. Flame-retarded or noncombustible fabrics, coatings, and adhesives complying with UL 181, Class 1.
2. Metal Edges: Construct from same material as ductwork, unless otherwise noted.
3. Fabric:
   a. Comply with NFPA 701 or UL 214 (except Teflon coated).
   b. Woven polyester or nylon for most applications.
   c. Woven fiberglass for high temperature applications.
   d. Coating: Vinyl.

C. Construction:

1. Fold and crimp metal edge strips onto fabric as illustrated in SMACNA Manual.
2. Standard Metal Edged Connectors: Strip of fabric 3 inches wide attached to two strips of 3-inch-wide sheet metal.
3. Wide Metal Edged Connectors: Strip of fabric 4 inches wide attached to two strips of 4-inch-wide sheet metal.
4. Extra Wide Metal Edged Connectors: Strip of fabric 6 inches wide attached to two strips of 6-inch-wide sheet metal.

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D. Manufacturers and Products:

1. Ductmate; PROflex, Commercial.
2. Ventfabrics.
3. Duro-Dyne.

2.15 CEILING ACCESS DOORS

A. Size: 30 inches by 30 inches.

B. Finish in baked white enamel.

C. Manufacturers:

1. Inryco Milcor.
2. Krueger.

2.16 DUCT INSPECTION DOORS

A. General:

1. Insulated, gasketed, and at least 15 inches by 15 inches when duct dimensions are large enough.
2. On ductwork where largest side dimension is less than 16 inches, furnish inspection doors at least 8 inches by 8 inches.
3. Complete with necessary hardware and either Amerlock 10 or Ventlock No. 100 latches, and Ventlock Series No. 100 hinges.
4. Fabricated of same material as ductwork.

B. Round Spin-in Type Access Doors:

1. Size: 18-inch and 24-inch diameter will be acceptable in lieu of comparable size square or rectangular access doors specified herein.
2. Complete with insulation, spin-in frame, inner door, attachment cable, gaskets, three latches, and pull ring.
3. Manufacturer and Product: Flexmaster; Inspector Series.

C. Casing and Plenum Access Doors:

1. Size: 57 inches high by 24 inches wide minimum where possible.
2. Complete with hardware, hinges, seals, and latch handles.
3. Doors and frames shall be designed to close with pressure.
4. Latch Handles: Ventlock, Series No. 260.
5. Hinges: Ventlock, Series No. 200 and No. 300.

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D. Manufacturers:

1. Ventlok.
2. Duro-Dyne.
3. Flexmaster.

2.17 MANUAL DAMPERS

A. Butterfly Manual Dampers:

1. Fabricate from two gauges heavier than duct in which installed, of same material as ductwork.
2. Align operating handle with damper blade.
3. Provide 2-inch standoff bracket for insulated duct systems.
4. Damper Manufacturers:
   a. Ruskin.
   b. American Warming and Ventilating.
5. Operator Manufacturers and Products:
   a. Accessible Ductwork: Ventlok; Type 620 or Type 635.
   b. Accessible Insulated Ductwork: Ventlok; Type 639.
   c. Concealed Ductwork: Ventlok; Type 677 with extended operating rod and concealed regulator with plain cover.

B. Manual Opposed-Blade Balancing Dampers (for Rectangular Ducts):

1. Externally operated gang single thickness, V-groove blades.
2. Suitable for up to 2,000 feet per minute air velocity, or 5 inch WC differential air pressure when closed. Up to 240 degrees F air temperature without seals.
3. AMCA 500 leakage at 1,500 fpm shall be max 10 CFM/sf (with seals), or 40 CFM/sf (without seals).
4. Seals shall be polyurethane.
5. Fabricate from 16-gauge galvanized steel, stainless steel, or equivalent aluminum channel frame, same material as ductwork.
6. Nylon sleeve bearings.
7. Construction shall have interlocking edges and maximum 6-inch blade width.
8. Manufacturers and Products:
   a. Ruskin; CD35.
   b. American Warming and Ventilating; Model VC-20.

2.18 BACK DRAFT DAMPERS

A. General: Damper pressure drop ratings shall be based on tests and procedures performed in accordance with AMCA 500.

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B. Aluminum, Counterbalanced, Standard Duty:

1. Fabrication:
   a. Frame: 2 inches by minimum 0.06 inch (51 mm by minimum 1.5 mm), 6063-T5 extruded aluminum channel with rear flange and mitered corners.
   b. Blades:
      1) Style: Single piece, overlap frame.
      2) Action: Parallel.
      3) Material: Minimum 0.025-inch (0.6 mm) 6063-T5 formed aluminum.
      4) Width: Maximum 6 inches (152 mm).
   c. Bearings: Corrosion-resistant, long-life, synthetic, formed as single piece with axles.
   d. Blade Seals: Extruded vinyl, mechanically attached to blade edge.
   e. Linkage: Concealed in frame.
   f. Axles: Corrosion-resistant, long-life, synthetic, locked to blade and formed as single piece with bearings.
   g. Counterbalances: Adjustable zinc plated steel weights mechanically attached to blade enabling damper to operate over wide range of pressures.
   h. Mounting:
      1) Suitable for mounting in vertical, horizontal airflow up, and horizontal airflow down positions.
      2) Configured for horizontal, airflow.
   i. Finish: Factory applied air-dried epoxy paint on all damper parts.
2. Performance Data:
   a. Temperature Rating: Withstand minus 40 degrees to 200 degrees F (minus 40 degrees to 93 degrees C).
   b. Maximum Back Pressure: 2-inch WC (500 Pa).
   c. Maximum Spot Air Velocity: 1,000 fpm (5 amps).
   d. Operation of Blades:
      1) Start to Open: 0.01-inch WC (0.002 kPa).
      2) Fully Open: 0.06-inch WC (0.01 kPa).
   e. Pressure Drop: Maximum 0.04-inch WC (0.01 kPa) at 1,000 fpm (305 mpm) through 24-inch by 24-inch (610 mm by 610 mm) damper.
3. Accessories:
   a. Factory Sleeve: Minimum 20-gauge thickness, minimum 12-inch length.
   b. Screen:
      1) Type: Bird.
      2) Location: Front with sleeve.
      3) Material: Aluminum.

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4. Manufacturers and Products:
    a. Ruskin; Model CBD2.
    b. Greenheck; Series 160, 360, 460.

2.19 FIRE, FIRE/SMOKE, SMOKE DAMPERS

A. Duct Mounted Fire Dampers in Fire Walls with Rating of 2 Hours or Less:

1. NFPA 90A dynamically rated for 1-1/2-hour service.
2. Blades, frame, and mounting angles same material as ductwork.
3. Accordion style folded blades.
4. 165 degrees F fusible link.
5. Approved for installation with 2-hour fire rating.
6. Rated, manufactured, tested, and approved in accordance with UL 555.
7. Blades out of airstream when open (Style B).
8. Furnish with sleeved frame for duct connections.
9. Labeled for use in dynamic mode.
10. Furnish dynamic and horizontal mounted dampers with springs for proper closure.
11. Corrosive Service Dampers Where Indicated: Type 316 stainless steel.
12. Manufacturers and Products:
    a. Nailor Industries; 1200 Series.
    b. Ruskin; FD60.

2.20 MISCELLANEOUS ACCESSORIES

A. Louver and Grille Blank-Off Sections:

1. Fabricate from 20-gauge sheets of same material as louver/grille.
2. Line with sound attenuation/insulating material.
3. Shop-prime and paint outside face of blank-off section with two coats of flat black exterior paint.

B. Auxiliary Drain Pans:

1. Dimensions: Minimum 6 inches larger in both dimensions than equipment it is serving and 2 inches high, minimum.
2. Construction: 16-gauge stainless steel with welded joints. Pans shall be watertight and have hemmed edges.
3. Drain Connection:
    a. Minimum 1-inch IPS or as shown on Drawings.
    b. Locate at lowest point of drain pan.
    c. In lieu of drain connection, float switch may be installed. Float switch shall shut down air handling equipment upon sensing water.

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C. Accessories Hardware:

1. Instrument Test Holes:
   a. Cast metal, material to suit duct material, including screw cap and gasket and flat mounting gasket.
   b. Size to allow insertion of pitot tube and other testing instruments.
   c. Provide in length to suit duct insulation thickness.
2. Flexible Duct Clamps:
   a. Stainless steel band with cadmium-plated hex screw to tighten band with worm-gear action.
   b. Provide in sizes from 3 inches to 18 inches to suit duct size.
3. Adhesives: High strength, quick setting, neoprene based, waterproof and resistant to gasoline, and grease.

PART 3 EXECUTION

3.01 GENERAL INSTALLATION

A. Miscellaneous:

1. Install sheet metal ductwork and flexible ductwork in accordance with SMACNA Manual, NFPA 90A, and NFPA 90B.
2. Install ductwork using manufacturer’s recommended adhesives, cement, sealant, and insulation accessories.
3. Align ductwork accurately at connections, within 1/8-inch misalignment tolerance and with internal surfaces smooth.
4. Interface Between Ductwork and Louvers: At locations where ductwork is connected to louver for either intake or exhaust purposes, ductwork shall be installed, sloped, and connected to louver so water entering ductwork system positively drains back to and out of louver.

B. Ductwork Location:

1. Locate ductwork runs vertically and horizontally, unless otherwise indicated.
2. Avoid diagonal runs wherever possible.
3. As indicated by diagrams, details, and notations or, if not otherwise indicated, run ductwork in shortest route that does not obstruct usable space or block access for servicing building and equipment.
4. In general, install as close to bottom of structure as possible.
5. For ductwork concealed above ceiling, maximize clearance between bottom of ductwork and top of ceiling construction.
6. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

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7. Ductwork that must transition and drop below piping or other ductwork shall be transitioned back to bottom of structure immediately adjacent to obstruction.

C. Penetrations:

1. Provide duct sleeves or prepared openings for duct mains, duct branches, and ducts passing through roofs, walls, and ceilings.
2. Clearances:
   a. For uninsulated ducts, allow 1-inch clearance between duct and sleeve, except at grilles, registers, and diffusers.
   b. For insulated ducts, allow 1-inch clearance between insulation and sleeve, except at grilles, registers, and diffusers.
3. Closure Collars:
   a. Minimum 4 inches wide on each side of walls or floors where sleeves or prepared openings are installed.
   b. Fit collars snugly around ducts and insulation.
   c. Same gauge and material as duct.
   d. Grind edges of collar smooth to preclude tearing or puncturing insulation covering or vapor barrier.
   e. Use fasteners with maximum 6-inch centers on collars.
4. Packing: Mineral fiber in spaces between sleeve or opening and duct or duct insulation.

D. Concealment:

1. Wherever possible in finished and occupied spaces, conceal ductwork from view by locating in mechanical shafts, hollow wall construction, or above suspended ceiling.
2. Do not encase horizontal runs in solid partitions, except as specifically shown.
3. Limit clearance to 1 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.

E. Coordination with Other Trades:

1. Coordinate duct installation with installation of accessories, dampers, coil frames, equipment, controls, and other associated work of ductwork system.
2. Ductwork shall be configured, positioned, and installed to permit installation of light fixtures as indicated on Drawings.

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3. Coordinate ductwork layout with suspended ceiling, lighting and sprinkler head layouts and similar finished work.
4. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.

F. Shower Room and Toilet Room Exhaust Ductwork:

1. Joints and Seams: Seal watertight.
2. Slope branch ducts downward to grille.

G. Fume Hood, Laboratory, and Chlorine Room Exhaust Ductwork:

1. Seal joints and seams with chemical-resistant mastic.
2. Rivet butt joints with minimum of eight pop rivets.

3.02 RECTANGULAR DUCTWORK

A. General:

1. Where possible, install ductwork so seams and joints will not be cut for installation of grilles, registers, or ceiling outlets.
2. If cutting of seams or joints is unavoidable, reinforce cut portion to original strength.

B. Low Pressure Taps:

1. Use bell mouth or conical fittings with integral locking quadrant damper. Spin-in fitting shall be sealed at duct tap with a gasket or sealed with sealant as specified for medium pressure ductwork.
2. Determine location of spin-in after outlet location is determined.
3. Fitting shall be securely attached to shaft to prevent damper from rotating around shaft.

C. Fittings:

1. Use bell-mouth or conical tee fittings for round duct takeoffs from rectangular mains.
2. Use 45-degree entry fittings conforming to SMACNA requirements for rectangular takeoffs from rectangular or round mains.
3. Make offsets with maximum angle of 45 degrees.
4. Use fabricated fittings for changes in directions, changes in size and shape, and connections.

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D. Rectangular Ductwork Transverse Joints:

1. Install each run with a minimum of joints.
2. Install couplings tight to duct wall surface with projections into duct at connections kept to a minimum.
3. Mechanical Joint Option:
   a. Construct transverse joints with Ductmate 25/35 duct connector systems, Ductmate W.D.C.I. Heavy/Lite duct connector systems, or Ductlok J/E duct connector system. Slip-on duct flange connectors shall have integral sealant pocket with permanently flexible sealant.
   b. When using Ductmate W.D.C.I. Heavy/Lite system, construct ductwork in accordance to the Ductmate W.D.C.I. Heavy J and Light H Assembly Manual and Duct Construction Standards.
   c. When using Ductlok J/E duct connector system, construct ductwork in accordance with Ductlok's Rectangular Duct Construction Manual for Low, Medium, and High Pressure.
   d. For longitudinal seams, use Pittsburgh lock seam sealed internally with permanently elastic sealer such as Ductmate 5511M mastic.
   e. Conform to SMACNA Class A sealing requirements.

3.03 RIGID ROUND DUCTWORK

A. General: Except where interrupted by fittings, install round ducts in lengths as long as possible to minimize joints.

B. Rigid Round Ductwork Joints:

1. Rigid round ductwork joints shall be in accordance with SMACNA HVAC Duct Construction Standards, Metal and Flexible, unless otherwise specified.
2. Single and Double Wall Supply and Return System Joints:
   a. Less than 36 Inches: Slip coupling.
   b. 36 Inches and Larger: Flanged connector, Van Stone, or welded companion flange type.
3. Single and Double Wall Exhaust and Return System Joints:
   a. Spiral Seam Duct: Welded flanged connector.
   b. Longitudinal Seam Duct: Van Stone flange connector.

3.04 INSULATED FLEXIBLE DUCT

A. Installation:

1. Where shown, between branch duct and ceiling diffusers and grilles.

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2. Without sags, kinks, sharp offsets, or elbows.
3. As straight and taut as possible.

B. Connection: Connect flexible ductwork to round collars, air distribution devices, and terminal units in accordance with flexible duct manufacturer's recommendations.

C. Length: Maximum length of low-pressure flexible duct (construction pressure class up to 2-inch WC) to be 5 feet.

D. Flexible ductwork shall not pass through wall, floor, or fire resistant rated assembly.

3.05 DUCTWORK HANGERS AND SUPPORTS

A. Install ductwork with support systems in accordance with SMACNA Manual, unless otherwise noted.

B. Support ducts rigidly with suitable ties, braces, hangers, and anchors of type, which will hold ducts true-to-shape and to prevent buckling.

C. Install additional bracing on ductwork as required, to prevent ballooning or breathing.

D. Support horizontal ducts within 2 feet of each elbow and within 4 feet of each branch intersection.

E. Support vertical ducts at maximum interval of 16 feet and at each floor.

F. Upper attachments to structures shall have allowable load not exceeding 1/4 of failure (proof test) load, but are not limited to specific methods indicated.

G. In new construction, install concrete insert prior to placing concrete.

H. Install seismic restraints on ductwork systems and sway bracing as described in SMACNA Guidelines for Seismic Restraints of Mechanical Systems.

3.06 FLEXIBLE CONNECTIONS

A. Flexible Collars and Connections:

1. Use between fans and ducts.
2. For round ducts, securely fasten flexible connections by zinc-coated steel clinch-type draw bands.
3. For rectangular ducts, lock flexible connections to metal collars.

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3.07 DAMPERS

A. General:

1. Inspection:
   a. Inspect areas to receive dampers.
   b. Notify Engineer of conditions that would adversely affect installation or subsequent utilization of dampers.
   c. Do not proceed with installation until unsatisfactory conditions are corrected.
2. Install dampers at locations indicated on Drawings and in accordance with manufacturer's installation instructions.
3. Install square and level.
4. Handle damper using sleeve or frame. Do not lift damper using blades or jack-shaft.
5. Damper blades and hardware shall operate freely without obstruction.
6. Damper blades and hardware that bind within frame or obstructed by adjacent construction will not be acceptable.
7. When installed, damper frames shall be gasketed or caulked to eliminate leakage between duct and damper frames.
8. Head and sill shall have stops.
9. Suitable for installation in mounting arrangement shown.
10. Do not compress or stretch damper frame into duct or opening.

B. Manual Dampers:

1. Provide balancing dampers for grilles and diffusers in branch duct as near main as possible.
2. Add or remove balancing dampers as requested by air balancing firm for necessary control of air.

C. Back Draft Dampers:

1. Install dampers square and free from racking with blades running horizontally.
2. Install bracing for multiple section assemblies to support assembly weight and to hold against system pressure. Install bracing as needed.

D. Fire Dampers:

1. At ceiling grille and diffuser fire dampers, provide thermal blankets where required by local authorities.
2. Install 1-1/2-hour rated, unless otherwise indicated, at locations shown and in accordance with SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC Systems.

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3.08 ACCESS DOORS

A. Ceilings: Install in nonaccessible ceilings below each motorized damper, terminal unit, smoke detector, and fire damper.

B. Ductwork:

1. Install access doors in ductwork, in accordance with manufacturer's instructions, at each:
   a. Duct mounted fire damper.
   b. Duct mounted smoke or ionization detector.
   c. Motorized damper.
   d. Sail switch.
   e. Turning vane.
   f. Automatic damper.
   g. Temperature controller.
   h. Coil, on both upstream and downstream side.

3.09 MISCELLANEOUS ACCESSORIES

A. Auxiliary Drain Pans:

1. Under equipment for which pan is shown on Drawings and under all horizontal air handling units located above ceilings and piping located in ceiling space directly above computer facility areas; furnish and install auxiliary drain pans.
2. Route drain lines to nearest floor or hub drain independent of any other drain.
3. Slope drain pans toward drain connection to promote drainage.

B. Louver and Grille Blank-Off Sections: Attach airtight to louver or grille and install to allow for easy removal.

C. Inspection Plates and Test Holes:

1. Where required in ductwork for balance measurements.
2. Test holes shall be airtight and noncorrosive with screw cap and gasket.
3. Extend cap through insulation.

3.10 DUCT SEALING

A. Seal duct seams and joints in accordance with SMACNA requirements per the SMACNA static pressure classification.

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B. If no specific duct sealing requirements are specified, requirements of SMACNA manual shall govern.

C. Seal externally insulated ducts prior to insulation installation.

D. Seal all audible leaks.

3.11 BALANCING OF AIR SYSTEMS

A. Perform air balancing in accordance with requirements of Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

3.12 PROTECTION OF INSTALLED WORK

A. Open ends of installed ductwork systems shall be covered to prevent dust, foreign objects, and water from entering ductwork.

B. Ductwork systems shall not be used for air conveyance until adequate air filtration devices are installed in air handling equipment, to prevent ingress of construction dust.

3.13 CLEANING

A. Ductwork shall be cleaned of rust, dust, and debris, both internally and externally, before placing in operation.

B. Before installing air outlets, use air handler to blow dry air through entire system at maximum attainable velocity. Provide temporary air filters for this operation.

C. If duct systems are found to contain construction debris at time of construction completion Contractor shall provide complete ductwork system cleaning in accordance with NADCA Standards.

END OF SECTION

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SECTION 23 34 00
HVAC FANS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Acoustical Society of America (ASA): S2.19, Mechanical Vibration—Balance Quality Requirements of Rigid Rotors—Part 1, Determination of Permissible Residual Unbalance.
2. Air Movement and Control Association International (AMCA):
   a. 99, Standards Handbook.
   b. 201, Fans and Systems.
   c. 203, Field Performance Measurement of Fan Systems.
   d. 204, Balance Quality and Vibration Levels for Fans.
   e. 210, Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating.
   f. 300, Reverberant Room Method for Sound Testing of Fans.
   g. 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
3. American Bearing Manufacturers Association (ABMA): 9, Load Ratings and Fatigue Life for Ball Bearings.
4. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE): 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
5. ASTM International (ASTM):
   a. B117, Standard Practice for Operating Salt Spray (Fog) Apparatus.
   b. D2247, Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
   c. D2794, Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
   d. D3363, Standard Test Method for Film Hardness by Pencil Test.
   e. D4167, Standard Specification for Fiber-Reinforced Plastic Fans and Blowers.
   f. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
6. National Electrical Manufacturers Association (NEMA).
7. National Fire Protection Association (NFPA): 45, Standard on Fire Protection for Laboratories Using Chemicals.
8. Occupational Safety and Health Act (OSHA).

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9. Society for Protective Coatings (SSPC):
    a. SP 3, Power Tool Cleaning.
    b. SP 5, White Metal Blast Cleaning.
    c. SP 6, Commercial Blast Cleaning.
    d. SP 10, Near-White Blast Cleaning.
10. UL: 507, Safety Standard for Electric Fans.

1.02 DEFINITIONS

A. The following is a list of abbreviations which may be used in this section:

1. ac: Alternating Current.
2. CISD: Chemical Industry, Severe-Duty.
3. dB: Decibel.
4. DWDI: Double Width, Double Inlet.
5. FRP: Fiberglass Reinforced Plastic.
6. hp: Horsepower.
7. ODP: Open Drip Proof.
8. SWSI: Single Width, Single Inlet.
9. TEFC: Totally Enclosed, Fan Cooled.
10. UV: Ultraviolet.
11. XP: Explosion Proof.

1.03 SUBMITTALS

A. Action Submittals:

1. Provide following for specified products:
    a. Identification as referenced in Contract Documents.
    b. Manufacturer’s name and model number.
    c. Descriptive specifications, literature, and drawings.
    d. Dimensions and weights.
    e. Fan sound power level data (reference 10 to power minus 12 watts) at design operating point.
    f. Fan Curves:
        1) Performance Curves Indicating:
            a) Relationship of flow rate to static pressure for various fan speeds.
            b) Brake horsepower curves.
            c) Acceptable selection range (surge curves, maximum revolutions per minute).
            d) Static pressure, capacity, horsepower demand and overall efficiency required at duty point, including drive losses.

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e) For induced flow discharge assemblies, provide performance curve to include fan volume versus static pressure performance as well as total volume versus static pressure.

2) For variable air volume applications, indicate operating points at 100 percent, 80 percent, 60 percent, and 40 percent of design capacity on fan curves including data to indicate effect of capacity control devices such as inlet vanes on flow, pressure, and brake horsepower.

g. Capacities and ratings.
h. Construction materials.
i. Fan type, size, class, drive arrangement, discharge, rotation, and bearings.
j. Wheel type, diameter, maximum revolutions per minute for fan class, operating revolutions per minute, and tip speed.
k. Motor data, including service factor and operating horsepower, as specified in Section 26 05 01, Electrical.
l. Fan shaft first critical speed.
m. Belt service factor.
n. Drive assembly horsepower rating.
o. Sheave horsepower rating.
p. Power and control wiring diagrams, including terminals and numbers.
q. Vibration isolation.
r. Factory finish system.
s. Color selection charts where applicable.
t. Corrosion protection coating product data.
u. Fiberglass Material: Statement of resins and reinforcing proposed for use.

2. Anchorage and bracing drawings and cut sheets, as required by Section 01 88 15, Anchorage and Bracing.
3. “Or-Equal” Equipment:
   a. Where submitted equipment results in change to fan inlet or outlet ductwork configuration shown on Drawings, submit system effect factor calculations indicating increased static pressure requirements as described in AMCA 201.
   b. Where submitted equipment results in change to ductwork and equipment configuration shown on Drawings, submit detailed information on structural, mechanical, electrical, or other modifications necessary to adapt arrangement to equipment furnished.

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B. Informational Submittals:

1. Anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Recommended procedures for protection and handling of products prior to installation.
3. Manufacturer's installation instructions.
4. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements, for the following:
   a. Motors specified to be premium efficient type.
   b. FRP fans.
5. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.
6. Test reports, including, but not limited to, factory run test, static and dynamic balance and vibration testing.
7. Operation and maintenance data in conformance with Section 01 78 23, Operation and Maintenance Data. Include as-built version of equipment schedules.

1.04 QUALITY ASSURANCE

A. Performance Ratings: Tested in accordance with AMCA 210.

B. Sound Ratings: Tested in accordance with AMCA 300.

C. Fabrication: In accordance with AMCA 99.

1.05 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following:

Item	Quantity
Vee Belts	One complete set per unit
Special tools required to maintain or dismantle	One complete set for each different size unit

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

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PART 2 PRODUCTS

2.01 EQUIPMENT SCHEDULES

A. Some specific equipment requirements are listed in Equipment Schedule. Refer to Drawings.

2.02 GENERAL

A. Spark Resistant Construction: Fans required to be spark resistant shall comply with requirements of AMCA 99-0401.

B. Operating Limits: Fans designated to meet a specified fan class shall comply with requirements of AMCA 99-2408.

C. Acoustical Levels: Equipment selections shall produce sound power levels in each octave band no greater than shown in Equipment Schedule.

D. Fan Drives:

1. Drive assembly shall be sized for a minimum 140 percent of fan motor horsepower rating.
2. Furnish multiple drive belts where motor horsepower is 2 hp or larger.
3. Sheaves:
    a. Capable of providing 150 percent of motor horsepower.
    b. Unless otherwise noted, furnish belt-driven fans with cast iron or flanged steel sheaves.
4. Drive Adjustment:
    a. When fixed-pitch sheaves are furnished, accomplish system air balancing by either trial of different fixed-pitch sheaves or use of temporary adjustable-pitch sheaves.
    b. Provide trial and final sheaves, as well as drive belts, as required.
5. Fan Shafts: First critical speed of at least 125 percent of fan maximum operating speed.
6. Provide speed test openings at shaft locations.
7. Belts: Oil and heat resistant, nonstatic type.
8. Motors:
    a. Motors 20 hp or Smaller:
        1) Variable pitch V-belt sheaves allowing at least 20 percent speed variation.
        2) Final operating point shall be at approximate sheave midpoint.
    b. Motors Larger than 20 hp: Fixed-pitch sheaves.
    c. Furnish motors for V-belt drives with adjustable rails or bases.

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9. Weather Cover: For outdoor applications, factory fabricated drive assembly of same material as fan housing, unless specified otherwise.
10. Belt and Shaft Guards:
    a. Easily removable and to enclose entire drive assembly, meeting federal, OSHA, and State of Oregon requirements.
    b. Guard faces of expanded metal having minimum 60 percent free area for ventilation.
    c. Bright yellow finish.

E. Finishes:

1. Carbon Steel Parts: Factory finish as follows, unless indicated otherwise.
    a. Parts cleaned and chemically pretreated with phosphatizing process.
    b. Alkyd enamel primer.
    c. Air dry enamel topcoat.
2. Aluminum Parts: Finished smooth and left unpainted, unless stated otherwise.
3. Stainless Steel Parts: Finished smooth and left unpainted.
4. Fiberglass Parts: Finished in accordance with Paragraph Fiberglass Material.

2.03 MODULAR MAKE-UP FAN-FILTERS (SF9761)

A. General:

1. Factory-assembled roof mounted supply air fan; including housing, hood, filters, centrifugal fan wheel, drive assembly, motor and accessories.
2. Bearing AMCA Certified Ratings Seal for sound and air performance.
3. Wind rated to 110 miles per hour.
4. Corrosion resistant coating inside and out with 4,000 hr/salt spray rating under ASTM B117 testing conditions.
5. Corrosion resistant fasteners, either stainless steel, or with equivalent coating.

B. Housing: Heavy-gauge G90 galvanized steel construction.

1. 1 inch mold resistant acoustic insulation on fan section.
2. removeable access panels with hinged doors.
3. Bolted to frame.

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C. Intake Hood and Prefilter:

1. Hood same material and coatings as housing.
2. Hood, filters, and frame shall be designed to traps dust, and prevent water intrusion to the main filters.
3. Metal Mesh Type Filter:
    a. Washable, 4-mesh aluminum screen media.
    b. Thickness: 2 inches.
    c. Minimum 25 percent dust spot efficiency in accordance with ASHRAE 52.2.
4. Max face velocity 600 fpm.

D. Main Filter and Frame:

1. Pleated Media Type:
    a. MERV8.
    b. Thickness: 2 inches.
2. Frames:
    a. Vee-bank.
    b. Aluminum holding frame, retainer, and sealer frame.
    c. To allow removal of filters without removal of hood.
3. Manufacturers:
    a. Camfil Farr.
    b. American Air Filter.
    c. Viledon.

E. Fan:

1. Forward curved steel centrifugal belt drive.
2. Internally isolated with neoprene isolators.

F. Shaft, Bearings, Drive:

1. Shaft:
    a. Turned, ground, and polished carbon steel.
    b. Keyed for sheave installation.
    c. Zinc-phosphate coated and oil emulsion-dipped.
2. Bearings: permanently lubricated.
3. Drives:
    a. In accordance with Paragraph Fan Drives.
    b. Factory set to specified fan revolutions per minute.

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G. Accessories:

1. Motorized Damper: Aluminum frame, aluminum blades, aluminum hinge pins with nylon bushings, 24V ac operator.
2. Supply fan starter with factory wired damper interlock.
3. 24V ac power supply factory wired and sized for thermostat, internal, and external damper operators.
    a. Additional two dry output contacts indicating assembly running or ON, rated 24V dc, 5 amps.
4. Factory wired to weather protected terminal strip for field wiring.
5. Bird Screens: Aluminum construction.
6. Roof Curb:
    a. Factory fabricated, steel construction, corrosion protected.
    b. Pressure-treated wood nailer.
    c. Insulation: Minimum 1-1/2 inches thick, 3 pounds per cubic foot density, rigid mineral fiberboard insulation with metal liner.
7. Disconnect: By electrical.
8. Filter Pressure Gauge:
    a. Each filter bank shall be furnished with magnehelic filter gauge (Dwyer Series 2000).
    b. With adjustable signal flag.
    c. Provide permanent markings at initial and recommended final differential pressures.

H. Manufacturers and Products:

1. Greenheck; Model MSX.
2. Cook; Model HMD.

2.04 CORROSION PROTECTION COATING

A. General:

1. Factory-applied corrosion protection coating for application to fan components and accessories, where required by this section.
2. Quality Control:
    a. Verify dry film thickness before final baking.
    b. Finished coating system shall be free from voids, checks, cracks, and blisters.
3. Surface Cleaning:
    a. Clean parts to be coated as follows:
        1) Immerse parts in heated cleaning solution to remove lubricants, machining oils, and residual factory contamination.

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2) Follow with immersion in potable water bath to neutralize and remove cleaning solution.
3) Chemical Pretreatment: Immerse parts in heated chemical solution, iron phosphate for steel, clear/yellow chromate for aluminum.

B. Baked Two-Stage Powder Coat:

1. Material: Two-coat process with zinc rich epoxy primer and polyester urethane top coat.
2. Application: Electrostatic spray.
3. Curing: Oven baked at a metal temperature not to exceed 400 degrees F.
4. Finished Thickness: 4-mil to 6-mil dry film thickness.
5. Performance:
   a. Coating shall meet or exceed following criteria:
      1) Salt Spray Test: Minimum 4,000-hour duration, per ASTM B117 test method.
      2) Cross-Hatch Adhesion: No failure per ASTM D3359-B test method.
      3) Impact Resistance: 100-inch pounds, ASTM D2794 test method.
      4) Pencil Hardness: 2H, ASTM D3363 test method.
      5) Service Temperature: Maximum 230 degrees F, continuous.

2.05 MOTORS

A. General:

1. Fan motors shall comply with provisions of Section 26 05 01, Electrical.
2. Provide integral self-resetting overload protection on single-phase motors.
3. Motors for fans specified for use with variable frequency drives shall be inverter duty type.
4. Motors shall not operate into service factor in any case.

B. Motor requirements shall be as follows, unless designated otherwise on Equipment Schedule:

1. Torque Characteristics: Sufficient to accelerate driven loads satisfactorily.
2. Winding Thermal Protection: None.
3. Space Heater: No.
4. Number of Speeds: Single.
5. Number of Windings: One.

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6. Shaft Type: Solid, carbon steel.
7. Mounting: As required for fan arrangement.

2.06 ACCESSORIES

A. Equipment Identification Plates: Furnish 16-gauge stainless steel identification plate securely mounted on each separate equipment component and control panel in a readily visible location. Plate shall bear 3/8-inch high engraved block type black enamel filled equipment identification number and letters indicated in this Specification and as shown on Drawings.

B. Lifting Lugs: Furnish suitably attached for equipment assemblies and components weighing over 100 pounds.

2.07 SOURCE QUALITY CONTROL

A. General:

1. Fan shall operate at single stable point as indicated by fan curve. Fans having two potential operating points are not acceptable.
2. Fan and motor combination shall be capable of delivering 110 percent of scheduled air quantity and static pressure. Motor shall not operate into motor service factor in any listed case.
3. Consider drive efficiency in motor selection according to manufacturer’s published recommendation or according to AMCA 203, Appendix L.

B. Testing Provisions:

1. Provide tachometer access holes large enough to accept standard tachometer drive shaft.
2. Center punch fan shaft to accommodate tachometer readings.

C. Acoustical Levels:

1. Perform noise tests in accordance with AMCA 300 and AMCA 301.
2. Fan sound power levels (dB, Reference 10^{-12} Watts) shall be no greater than scheduled values.

D. Balancing:

1. Unless noted otherwise, each fan wheel shall be statically and dynamically balanced to ASA S2.19 Grade G6.3.

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2. Fans controlled by variable frequency drives shall be dynamically balanced at speeds 25 percent, 50 percent, 75 percent, and 100 percent of design revolutions per minute.

E. Vibration:

1. Provide factory vibration test report for each fan as part of factory quality assurance.
2. Provide factory vibration test report for all fans specified for vibration testing as required in Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fans level and plumb.

B. Secure roof-mounted fans to roof curbs with Type 316 stainless steel hardware.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Scroll Drains: Pipe drain connection through running trap to floor drain.

E. Labeling:

1. Label fans in accordance with Article Accessories.
2. Mark exhaust fans serving fume hoods with arrows to indicate proper direction of rotation, in accordance with NFPA 45.

F. Service Access: Locate units to provide access spaces required for motor, drive, bearing servicing, and fan shaft removal.

G. Equipment Support and Restraints:

1. Install floor-mounted units on concrete bases designed to withstand, without damage to equipment, the seismic force required by code.
2. Secure vibration and seismic controls to concrete bases using anchor bolts cast in concrete base.
3. Seismic Restraint Snubbers: Install with sufficient clearance so unit isolators are not restricted for proper free isolation, but do limit movement in all directions.

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H. Connections:

1. Refer to Section 23 31 13, Metal Ducts and Accessories.
2. Isolate duct connections to fans.
3. Install ductwork adjacent to fans to allow proper service and maintenance.

3.02 FIELD QUALITY CONTROL

A. Functional Tests:

1. Verify blocking and bracing used during shipping are removed.
2. Verify fan is secure on mountings and supporting devices, and connections to ducts and electrical components are complete.
3. Verify proper thermal-overload protection is installed in motors, starters, and disconnect switches.
4. Verify cleaning and adjusting are complete.
5. Disconnect fan drive from motor; verify proper motor rotation direction and verify fan wheel free rotation and smooth bearing operation.
6. Reconnect fan drive system; align and adjust belts and install belt guards.
7. Verify lubrication for bearings and other moving parts.
8. Verify manual and automatic volume control and fire and smoke dampers in connected ductwork are in fully open position.

B. Performance Tests:

1. Starting Procedures:
   a. Energize motor and adjust fan to indicated revolutions per minute.
   b. Measure and record motor voltage and amperage.
2. Operational Test:
   a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   b. Repair or replace malfunctioning units; retest as specified after repairs or replacement is made.
   c. Test and adjust control safeties.
   d. Replace damaged and malfunctioning controls and equipment.

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3.03 MANUFACTURER'S SERVICES

A. Manufacturer's Representative:

1. Present at site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:
   a. 1/2 person-day for installation assistance and inspection, and Owner training.
   b. 1/2 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
   c. Training shall not commence until an accepted detailed lesson plan for each training activity has been reviewed by Engineer.

B. Refer Section 01 43 33, Manufacturers' Field Services, and Section 01 91 14, Equipment Testing and Facility Startup.

3.04 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Lubricate bearings.

D. Balancing:

1. Perform air system balancing as specified in Section 23 05 93, Testing, Adjusting, and Balancing for HVAC.
2. Replace fan and motor sheaves as required to achieve design airflow.

E. Vibration Testing:

1. Perform field testing on rotating equipment, where specified in Section 23 05 93, Testing, Adjusting, and Balancing for HVAC, to determine actual operating vibration.
2. If vibration limits described therein are exceeded, rebalance equipment in-place until design tolerances are met.
   a. Vibration readings as measured at actual rotational speed shall not exceed the following values:
      1) Flexibly Mounted: 0.35 inch per second peak velocity.
      2) Rigidly Mounted: 0.25 inch per second peak velocity.

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3.05 CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes.

B. On completion of installation, internally clean fans according to manufacturers' written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.

END OF SECTION

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SECTION 23 37 00
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Air-Conditioning, Heating, and Refrigeration Institute (AHRI): 880, Air Terminals.
2. ASTM International (ASTM): C636/C636M, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
3. UL.

1.02 DEFINITIONS

A. NC: Noise Criteria; background sound rating method for indoor sound.

B. VAV: Variable air volume.

C. WC: Water column.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Manufacturer’s data and descriptive literature.
   b. Furnish the following information for each type of diffuser, register, and grille furnished.
      1) NC sound data.
      2) Static pressure loss data.
      3) Throw data.

PART 2 PRODUCTS

2.01 CEILING DIFFUSERS

A. Premium Louvered Face Diffusers (CD1):

1. Construction:
   a. Material: Aluminum.

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b. Finish: Baked white enamel. Flat black interior.
c. Neck: Round.

2. Removable core section of louvers.
3. Continuous sponge rubber gasket at face flange.
4. Performance:
   a. Distribution Pattern: As shown on Drawings.
   b. Maximum Pressure Drop: 0.10-inch WC.
   c. Sound: Maximum NC 30.
5. Manufacturers and Products:
   a. Carnes; Type SE (aluminum).
   b. Krueger; Model 5SHR (aluminum).
   c. Titus; Model TDCA-AA (aluminum).

2.02 SUPPLY GRILLES AND REGISTERS

A. Supply Grilles and Registers (SG1):

1. Construction:
   a. Material: Aluminum.
   b. Finish: Baked white enamel face finish.
   c. SR Register Accessories:
      1) Gang-operated opposed-blade volume control damper.
      2) Material to match grille.
2. Adjustable front horizontal and rear vertical vanes on 3/4-inch centers.
3. Continuous sponge rubber gasket at face flange.
4. 1-inch minimum flat rectangular frame.
5. Performance:
   a. Maximum Pressure Drop: 0.10-inch WC.
   b. Sound: Maximum NC 30.
6. Manufacturers and Products:
   a. Krueger; 880/5880 Series.
   b. Titus; 300 Series.

2.03 RETURN, EXHAUST AND TRANSFER GRILLES AND REGISTERS

A. Louvered Return, Exhaust and Transfer Grilles and Registers (RG1, TG1):

1. Construction:
   a. Material: Aluminum.
   b. Finish: Baked white enamel.
   c. RR and ER Register Accessories:
      1) Gang-operated opposed-blade volume control damper.
      2) Material to match grille.
2. Fixed horizontal louvers set at 35 degrees to 45 degrees.

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3. 1-inch minimum flat, rectangular frame.
4. Manufacturers and Products:
   a. Krueger; S80/S580H Series.
   b. Carnes; Type RAAAH.
   c. Titus; 350 Series.

PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to plans for coordination of locations of air outlets and inlets.

B. Install diffusers, grilles, and registers tight on their respective mounting surfaces, level, plumb, and true with room dimensions and duct.

END OF SECTION

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SECTION 26 05 01
ELECTRICAL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway Transportation Officials (AASHTO).
2. ASTM International (ASTM):
   a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   b. A240/A240M, Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.
   c. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   d. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   e. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
3. Electronic Industries Association (EIA/TIA): 569, Commercial Building Standard for Telecommunications Pathways and Spaces.
4. Federal Specifications (FS):
   a. W-C-596, Connector, Electrical, Power, General Specification for.
   b. W-S-896, Switch, Toggle (Toggle and Lock), Flush Mounted (General Specification).
5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
   b. PC62.41.1, Draft Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
   c. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
   d. 114, IEEE Standard Test Procedure for Single-Phase Induction Motors.
6. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

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7. National Electrical Contractor's Association, Inc. (NECA): 1, Standard Practices for Good Workmanship in Electrical Contracting.
8. National Electrical Manufacturers Association (NEMA):
    a. C80.1, Rigid Steel Conduit-Zinc Coated.
    b. C80.3, Electrical Metallic Tubing-Zinc Coated.
    c. C80.6, Intermediate Metal Conduit-Zinc Coated (IMC).
    d. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
    e. CC1, Electrical Power Connectors for Substations.
    f. ICS 1, Industrial Control and Systems: General Requirements.
    g. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated Not More Than 2000 Volts AC or 750 Volts DC.
    h. ICS 2.3, Industrial Control and Systems: Instructions for the Handling, Installation, Operation and Maintenance of Motor Control Centers.
    i. MG 1, Motors and Generators.
    j. PB 1, Panelboards.
    k. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
    l. ST 20, Dry Type Transformers for General Applications.
    m. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
    n. TC 3, PVC Fittings for Use with Rigid PVC Conduit and Tubing.
    o. WC 55, Instrumentation Cables and Thermocouple Wire.
    p. WC 70, Standard for Non-Shielded Power Cables Rated 2000 V or Less for the Distribution of Electrical Energy.
    q. WC 71, Standard for Non-Shielded Cables Rated 2001-5000 Volts for use in the Distribution of Electrical Energy.
    r. WC 74, 5-46 KV Shielded Power Cable for use in the Transmission and Distribution of Electric Energy.
    s. WD 1, General Color Requirements for Wiring Devices.
9. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
10. UL:
    a. 1, Flexible Metal Conduit.
    b. 6, Electrical Rigid Metal Conduit—Steel.
    c. 13, Power-Limited Circuit Cables.
    d. 44, Thermoset Insulated Wires and Cables.
    e. 62, Flexible Cord and Fixture Wire.
    f. 67, Panelboards.
    g. 98, Enclosed and Dead-Front Switches.
    h. 198C, High Interrupting Capacity Fuses, Current Limiting Types.
    i. 198E, Class R Fuses.
    j. 360, Liquid-Tight Flexible Steel Conduit.

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k. 486A, Wire Connectors and Soldering Lugs for Use with Copper Conductors.
l. 486C, Splicing Wire Connectors.
m. 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
n. 508, Industrial Control Equipment.
o. 510, Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
p. 514B, Fittings for Cable and Conduit.
q. 651, Schedule 40 and 80 PVC Conduit.
r. 674, Electric Motors And Generators for use in Division 1 Hazardous (Classified) Locations.
s. 797, Electrical Metallic Tubing.
t. 854, Service-Entrance Cables.
u. 870, Wireways, Auxiliary Gutters, and Associated Fittings.
v. 943, Ground-Fault Circuit Interrupters.
w. 1059, Terminal Blocks.
x. 1242, Intermediate Metal Conduit.
y. 1277, Electrical Power and Control Tray Cables with Optional Optical-Fibre Members.
z. 1449, Transient Voltage Surge Suppressors.
aa. 1561, Dry-Type General Purpose and Power Transformers.
bb. 2111, Overheating Protection for Motors.

1.02 DEFINITIONS

A. AHJ: Authority Having Jurisdiction.

1.03 SUBMITTALS

A. Action Submittals:

1. Boxes and device plates.
2. Junction and pullboxes.
3. Wiring devices.
4. Circuit breakers.
5. Control devices, terminal blocks, and relays.
6. Support and framing channels.
7. Nameplates and nameplate schedule.
8. Conduit, fittings, and accessories.
9. Conductors, cable, and accessories.
10. Motors: Nameplate data, detailed information on any special features.

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11. Motor Controls: Arrangement drawings, ratings, schematic and wiring diagrams, bill of materials, nameplate schedule, manufacturer information on components.
12. Local Control Panels: Arrangement drawings, schematic and wiring diagrams, bill of materials, nameplate schedule, manufacturer information on components.

B. Informational Submittals:

1. Factory test reports.
2. Field test reports.
3. Signed permits indicating Work is acceptable to regulatory authorities having jurisdiction.
4. Operation and Maintenance Data:
   a. As specified in Section 01 78 23, Operation and Maintenance Data.
   b. Provide for all equipment, as well as each device having features that can require adjustment, configuration, or maintenance.
   c. Minimum information shall include manufacturer's preprinted instruction manual, one copy of the approved submittal information for the item, tabulation of any settings, and copies of any test reports.

1.04 APPROVAL BY AUTHORITY HAVING JURISDICTION

A. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

B. Materials and equipment manufactured within the scope of standards published by UL, shall conform to those standards, and shall have an applied UL listing mark or label.

1.05 QUALIFICATIONS

A. PVC-Coated, Rigid Steel Conduit Installer: Must be certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.

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1.06 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

1. Fuses, 0 Volt to 600 Volts: Six of each type and each current rating installed.

PART 2 PRODUCTS

2.01 GENERAL

A. Products shall comply with all applicable provisions of NFPA 70.

B. Like Items of Equipment: End products of one manufacturer in order to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's service.

C. Equipment and Devices Installed Outdoors or in Unheated Enclosures: Capable of continuous operation within ambient temperature range of 20 degrees F to 104 degrees F.

D. Hazardous Areas: Products shall be acceptable to the regulatory authority having jurisdiction for the class, division, and group of hazardous area indicated.

E. Equipment Finish:

1. Manufacturer's standard finish color, except where specific color is indicated.
2. If manufacturer has no standard color, finish equipment in accordance with Section 09 90 00, Painting and Coating.

2.02 DEVICE BOXES

A. PVC-Coated Cast Metal:

1. Type: One-piece.
2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
3. Coating:
   a. All Exterior Surfaces; 40 mils PVC.
   b. All Interior Surfaces, 2 mils urethane.
4. Manufacturers:
   a. Robroy Industries.
   b. Ocal.

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2.03 JUNCTION AND PULL BOXES

A. Conduit Bodies Used as Junction Boxes: As specified under Article Conduit and Fittings.

B. Large Stainless Steel Box:

1. NEMA 250, Type 4X.
2. Box: 14-gauge, ASTM A240, Type 304stainless steel.
3. Cover: Hinged with clamps.
4. Hardware and Machine Screws: ASTM A167, Type 304 stainless steel.
5. Manufacturers:
    a. Hoffman Engineering Co.
    b. Robroy Industries.

2.04 WIRING DEVICES

A. Receptacle, Special Purpose:

1. Pin & Sleeve:
    a. UL 1686.
    b. Rating and number of poles as shown or as required for anticipated purpose.
    c. One matching plug with cord-grip features for each special-purpose receptacle.
    d. Housing:
        1) Impact-resistant, nonmetallic, single-gang, while in-use, NEMA 3R rating.
        2) Stainless steel mounting and hinge hardware.
    e. Lockable, paintable.
    f. Manufacturer: Meltric, Series DN9C.

B. Snap Switch, Motor-Rated:

1. Type: Two- or three-pole, manual motor starting/disconnect switch without overload protection.
2. Enclosure/Mounting and Rating:
    a. Totally enclosed snap-action switch. Quick-make, slow-break design with silver alloy contacts. Listed UL 508.
    b. Rating: 30 amperes, 15HP, 600V ac.
    c. Screw-type terminals.
    d. Provide lockable external handle operator.

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3. Manufacturers:
   a. General Purpose:
      1) Hubbell-Bryant.
      2) Leviton.
   b. Explosion-Proof: Eaton, Type EFD.

2.05 CIRCUIT BREAKER

A. UL 489 listed for use at location of installation.

B. Minimum Interrupt Rating: Match existing panelboard rating as a minimum.

C. Thermal-magnetic, quick-make, quick-break, molded case of indicating type showing ON/OFF and TRIPPED positions of operating handle.

D. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.

E. Type: Bolt-on circuit breakers in all panelboards.

F. Multipole circuit breakers designed to automatically open all poles when an overload occurs on one pole.

G. Do not use tandem or dual circuit breakers in normal single-pole spaces.

H. Manufacturers: Match existing panelboard.

2.06 FUSE, 0 TO 600 VOLTS

A. Provide to fit mountings specified with switches and features to reject Class H fuses.

B. Transformer Circuits, 0 to 600 Volt:

1. Amperage: 0 to 600.
2. UL 198E, Class RK-1, dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Type LPS-RK.
   b. Littelfuse, Inc.; Type LLS-RK.

C. Transformer Circuits, 0 to 250 Volt:

1. Amperage: 0 to 600.
2. UL 198E, Class RK-1, dual element, with time delay.

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3. Manufacturers and Products:
   a. Bussmann; Type LPN-RK.
   b. Littelfuse, Inc.; Type LLN-RK.

2.07 PUSHBUTTONS, INDICATING LIGHTS, AND SELECTOR SWITCHES

A. Type: Heavy-duty, oiltight. Provide contact arrangements, colors, inscriptions, and functions as shown.

B. Contact Rating: NEMA ICS 2, Type A600.

C. Unless otherwise shown, provide the following features:

1. Selector Switch Operating Lever: Standard.
2. Indicating Lights: Push-to-test, transformer-type.
3. Pushbutton Color:
   a. ON or START: Black.
   b. OFF or STOP: Red.
4. Pushbuttons and selector switches lockable in OFF position where indicated.

D. Legend Plate:

1. Material: Aluminum.
2. Engraving: Indicating specific function, or as shown.
3. Letter Height: 7/64 inch.

E. Manufacturers and Products:

1. General Electric Co.; Type CR 104P.
2. Square D Co.; Type T.
3. Eaton; Type 10250T.

2.08 TERMINAL BLOCKS

A. Type: UL 1059. Compression screw clamp, with current bar providing direct contact with wire and yoke, with individual rail mounted terminals. Marking system shall permit use of preprinted or field-marked tags.

B. Yokes and Clamping Screws: Zinc-plated, hardened steel.

C. Rating: 600V ac.

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D. Manufacturers:

1. Weidmuller, Inc.
2. Ideal.

2.09 MAGNETIC CONTROL RELAYS

A. NEMA ICS 2, Class A600 (600 volts, 10 amperes continuous, 7,200VA make, 720VA break), machine tool type with field convertible contacts.

B. Manufacturer and Model:

1. Eaton; Type M-600.
2. General Electric; Type CR120B.

2.10 CURRENT MONITORING RELAY

A. Features:

1. Type: AC Current switch.
2. Function: Detect motor current and activate switch at low current.
3. Current Range: 0.75A to 50A, adjustable.
4. Operating Temperature: 5 degrees F to 140 degrees F.
5. Power: Induced from the monitored load.
6. Isolation: 600V ac.
7. Mounting: Adjustable Mounting Bracket, installed within the motor starter unit.
8. Output: Solid state contact, normally-open (held closed during normal operation), rated 0.2A at 120V ac.
9. Approval: UL 508.

B. Manufacturers:

1. Veris, Type Hawkeye 809.
2. Eaton; Type D65CE.
3. Allen-Bradley; 809S.

2.11 CONTROL POWER TRANSFORMERS

A. Type: Self-cooled, two-winding.

B. UL 1561 and NEMA ST 1.

C. Insulation Class, Temperature Rise, and Impedance: Manufacturer’s standard.

D. Core and Coil: Encapsulated.

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E. Sound Level: Not to exceed NEMA ST 20 levels.

F. Vibration isolators to minimize and isolate sound transmission.

G. Manufacturers:

1. General Electric.
2. Eaton.
3. Square D.

2.12 SUPPORT AND FRAMING CHANNELS

A. Carbon Steel Framing Channel:

1. Material: Rolled, mild strip steel, 12 gauge, ASTM A1011/A1011M, Grade 33.
2. Finish: Hot-dip galvanized after fabrication.

B. Stainless Steel Framing Channel: Rolled, ASTM A167, Type 316 stainless steel, 12 gauge.

C. Manufacturers:

1. B-Line Systems, Inc.
2. Unistrut Corp.

2.13 NAMEPLATES

A. Material: Laminated plastic.

B. Attachment: Adhesive.

C. Color: Black, engraved to a white core, or as shown.

D. Engraving:

1. Devices and Equipment: Name or tag shown, or as required.
2. Panelboards:
   a. Designation.
   b. Service voltage.
   c. Phases.
3. Minimum Requirement: Label metering and power distribution equipment, local control panels, junction boxes, motor controls, and transformers.

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E. Letter Height:

1. Pushbuttons, Selector Switches, and Other Devices: 1/8 inch.
2. Equipment and Panelboards: 1/4 inch.

2.14 CONDUIT AND FITTINGS

A. Rigid Galvanized Steel Conduit (RGS):

1. Meet requirements of NEMA C80.1 and UL 6.
2. Material: Hot-dip galvanized, with chromated protective layer.

B. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:
   a. Meet requirements of NEMA C80.1 and UL 6.
   b. Exterior Finish: PVC coating, 40 mils nominal thickness, bond to metal shall have tensile strength greater than PVC.
   c. Interior finish: Urethane coating, 2 mils nominal thickness.
3. Threads: Hot-dipped galvanized and factory coated with urethane.
4. Bendable without damage to either interior or exterior coating.

C. Flexible Metal, Liquid-Tight Conduit:

1. UL 360 listed for 105 degrees C insulated conductors.
2. Material: Galvanized steel, with an extruded PVC jacket.

D. Flexible Coupling, Hazardous Locations:

1. Approved for use in the atmosphere involved.
2. Rating: Watertight and UL listed for use in Class I, Division 1 and Division 2 areas.
3. Outer bronze braid and an insulating liner.
4. Conductivity equal to a similar length of rigid metal conduit.
5. Manufacturers and Products:
   a. Crouse-Hinds; Type ECGJH or ECLK.
   b. Appleton; EXGJH or EXLK.

E. Fittings:

1. Provide bushings, grounding bushings, conduit hubs, conduit bodies, couplings, unions, conduit sealing fittings, drain seals, drain/breather fittings, expansion fittings, and cable sealing fittings, as applicable.

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2. Rigid Galvanized Steel:
   a. Meet requirements of UL 514B.
   b. Type: Threaded, galvanized.
3. PVC-Coated Rigid Galvanized Steel Conduit:
   a. Meet requirements of UL 514B.
   b. Fittings: Rigid galvanized steel type, PVC-coated by conduit manufacturer.
   c. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC-coated by conduit manufacturer.
   d. Finish: 40-mil PVC exterior, 2-mil urethane interior.
   e. Overlapping pressure sealing sleeves.
   f. Conduit Hangers, Attachments, and Accessories: PVC-coated.
   g. Manufacturers:
      1) Robroy Industries.
      2) Ocal.
   h. Expansion Fitting Manufacturer and Product: Ocal; Ocal-Blue XJG.
4. Flexible Metal, Liquid-Tight Conduit:
   a. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
   b. Insulated throat and sealing O-rings.
5. Flexible Coupling, Hazardous Locations:
   a. Approved for use in the atmosphere involved.
   b. Rating: Watertight and UL listed for use in Class I, Division 1 and Division 2 areas.
   c. Outer bronze braid and an insulating liner.
   d. Conductivity equal to a similar length of rigid metal conduit.
   e. Manufacturers and Products:
      1) Crouse-Hinds; Type ECGJH or ECLK.
      2) Appleton; EXGJH or EXLK.

2.15 CONDUIT ACCESSORIES

A. Identification Devices:

1. Raceway Tags:
   a. Material: Permanent, nonferrous metal.
   b. Shape: Round.
   c. Raceway Designation: Pressure stamped, embossed, or engraved.
   d. Tags relying on adhesives or taped-on markers not permitted.

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B. Raceway Band:

1. Slip-on Type:
   a. Provide heat-shrinkable, black, medium-wall polyolefin tubing with factory-applied adhesive/sealant. Select product size based upon raceway outside diameter.
   b. Manufacturer and Product: 3M; Type IMCSN, medium wall cable sleeve.
2. Wrap-around Type:
   a. Provide 4-inch width, 20-mil thickness, nonprinted black PVC corrosion protection tape with primer.
   b. Manufacturer and Product: 3M; Type Scotchrap 51 with Scotchrap Pipe Primer.

2.16 CONDUCTORS AND CABLES

A. Conductors 600 Volts and Below:

1. Conform to applicable requirements of NEMA WC 71, WC 72, and WC 74.
2. Conductor Type:
   a. 120-Volt and 277-Volt Lighting, No. 10 AWG and Smaller: Solid copper.
   b. 120-Volt Receptacle Circuits, No. 10 AWG and Smaller: Solid copper.
   c. All Other Circuits: Stranded copper.
3. Insulation: Type THHN/THWN.

B. 600-Volt Rated Cable:

1. General:
   a. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 20,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.
   b. Permanently and legibly marked with manufacturer’s name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
   c. Suitable for installation in open air, in cable trays, or conduit.
   d. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
   e. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

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2. Type TSP, No. 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 55 requirements.
    a. Outer Jacket: 45 mils nominal thickness.
    b. Individual Pair Shield: 1.35 mils, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
    c. Dimension: 0.31-inch nominal outside diameter.
    d. Conductors:
        1) Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
        2) 20 AWG, seven-strand tinned copper drain wire.
        3) Insulation: 15 mils nominal PVC.
        4) Jacket: 4 mils nominal nylon.
        5) Color Code: Pair conductors black and red.
    e. Manufacturer: Okonite Co.

C. Accessories:

1. Tape:
    a. General Purpose, Flame Retardant: 7 mils, vinyl plastic, Scotch Brand 33, rated for 90 degrees C minimum, meeting requirements of UL 510.
2. Identification Devices:
    a. Sleeve-type, permanent, PVC, yellow or white, with legible machine-printed black markings.
    b. Manufacturer and Products: Raychem; Type D-SCE or ZH-SCE.
3. Connectors and Terminations:
    a. Nylon, Self-Insulated Crimp Connectors:
        1) Manufacturers and Products:
            a) Thomas & Betts; Sta-Kon.
            b) Burndy; Insulug.
            c) ILSCO.
4. Self-Insulated, Freespring Wire Connector (Wire Nuts):
    a. Plated steel, square wire springs.
    b. UL Standard 486C.
    c. Manufacturers and Products:
        1) Thomas & Betts.
        2) Ideal; Twister.
5. Cable Lugs:
    a. In accordance with NEMA CC 1.
    b. Rated 600 volts of same material as conductor metal.

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c. Uninsulated Crimp Connectors and Terminators:
   1) Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
   2) Manufacturers and Products:
      a) Thomas & Betts; Color-Keyed.
      b) Burndy; Hydent.
      c) ILSCO.

d. Uninsulated, Bolted, Two-Way Connectors and Terminators:
   1) Manufacturers and Products:
      a) Thomas & Betts; Locktite.
      b) Burndy; Quiklug.
      c) ILSCO.

6. Cable Ties:
   a. Nylon, adjustable, self-locking, and reusable.
   b. Manufacturer and Product: Thomas & Betts; TY-RAP.
7. Heat Shrinkable Insulation:
   a. Thermally stabilized, crosslinked polyolefin.
   b. Manufacturer and Product: Thomas & Betts; SHRINK-KON.

2.17 MOTORS

A. Three-Phase:

1. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.
2. Meet requirements of NEMA MG 1.
3. Provide motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.
4. Motors shall be specifically designed for use and conditions intended, with a NEMA design letter classification to fit application.
5. Lifting lugs on motors weighing 100 pounds or more.
6. Operating Conditions: Maximum ambient temperature not greater than 40 degrees C.
7. Horsepower Rating: As designated in motor-driven equipment specifications. Brake horsepower of the driven equipment at any operating condition shall not exceed motor nameplate horsepower rating, excluding any service factor.
8. Service Factor: 1.15 minimum at rated ambient temperature, unless otherwise shown.
9. Voltage and Frequency Rating: 460V ac, 60 Hz, unless otherwise indicated in motor-driven equipment specifications.
10. Suitable for full voltage starting.

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11. Efficiency and Power Factor: Provide premium efficiency units, except for under 1 hp, multispeed, or short-time rated motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists. Provide standard power factor.
12. Insulation Systems: Unless otherwise indicated in motor-driven equipment specifications, Class B or Class F at nameplate horsepower and designated operating conditions, except EXP motors that shall be Class B with Class B rise.
13. Enclosures:
    a. Open drip-proof, unless specified otherwise in the motor-driven equipment specification. Provide screens over air openings. Enclosures shall conform to NEMA MG 1.
    b. TEFC and TENV: Furnish with a drain hole with porous drain/weather plug.
    c. Equipment Finish: Manufacturer's standard.
14. Nameplates: In accordance with NEMA MG1.
15. Multispeed: Meet requirements for speeds, number of windings, and load torque classification indicated in the motor-driven equipment specifications.

B. Manufacturers:

1. General Electric.
2. Reliance Electric.
3. U.S. Electrical Motors.

C. Factory Testing:

1. Tests:
    a. In accordance with IEEE 112 for polyphase motors and IEEE 114 for single-phase motors.
    b. Provide routine (production) tests on all motors in accordance with NEMA MG 1. Test multispeed motors at all speeds.
    c. For premium efficiency motors, test efficiency and power factor at 50 percent, 75 percent, and 100 percent of rated horsepower:
        1) In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraph 12.54 and Paragraph 12.57.
        2) Furnish a copy of a certified motor efficiency test report for identical motor.
2. Test Report Forms:
    a. Routine Tests: IEEE 112, Form A-1.
    b. Efficiency and power factor by Test Method B, IEEE 112, Form A-2, and NEMA MG 1, Paragraph (table) 12.57.

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2.18 GROUNDING

A. Ground Conductors: As specified in Article Conductors and Cable.

2.19 MOTOR CONTROL CENTERS

A. General:

1. Suitable for installation in existing Westinghouse Five Star series Motor Control Center.
2. In accordance with NEMA ICS 1, NEMA ICS 2, NEMA ICS 18, and UL 845.
3. Make adjustments as necessary to wiring, conduit, disconnect devices, motor starters, branch circuit protection, and other affected material or equipment to accommodate motors and motor ratings actually provided.
4. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
5. Lifting lugs on all equipment and devices weighing over 100 pounds.
6. Equipment to be fully rated without any derating for operating conditions.

B. Motor Control Unit:

1. Provide indicated individual components and control devices including pushbuttons, selector switches, indicating lights, control relays, time delay relays, and elapsed time meters as specified in other articles of this section and shown on Drawings.
2. Rating: Horsepower rated at 600 volts, UL labeled for 42,000 amperes with overload protection.
3. Wiring: NEMA ICS 18, Part 3, Class I, Type B.
4. Construction:
   a. Individual compartments separated by steel barriers for each starter, feeder, or other unit capable of being wired from front without unit removal.
   b. Compartment Doors: Separate hinged doors for each starter, feeder, or other unit.
   c. Door Interlocking: Mechanically interlock starter and feeder doors so doors cannot be opened with unit energized. Provide defeater mechanism to allow intentional access and energizing at any time by qualified individual.
   d. External disconnect handles with ON/OFF and trip positions showing, padlockable in OFF position with up to three-lock capability.
   e. Drawout combination type with stab connections.

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f. Readily interchangeable with starters of similar size.
g. Pull-apart unit control wiring terminal boards capable of accepting up to two No. 14 AWG wires minimum.

5. Electronic Overload Protection:
   a. Inverse-time-limit characteristic.
   b. Relay Trip: Integral, selectable trip class.
   c. Manual reset with indicator.
   d. Provide in each ungrounded phase.
   e. Integral with contactor.
   f. Provide N.O. auxiliary contact for remote status indication.
6. Control Transformer:
   a. Two winding, 120-volt secondary, primary voltage to suit.
   b. Two current-limiting fuses for primary circuit.
   c. One fuse in secondary circuit.
   d. Mount within starter unit.

PART 3 EXECUTION

3.01 GENERAL

A. Install materials and equipment in accordance with manufacturer's instructions and recommendations.

B. Work shall comply with all applicable provisions of NECA 1.

C. Install materials and equipment in hazardous areas in a manner acceptable to regulatory authority having jurisdiction for the class, division, and group of hazardous areas shown.

D. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

E. Location and Enclosure Type: See Environmental Conditions and Materials Application Table on Drawings.

3.02 DEMOLITION

A. General Demolition:

1. Where shown, de-energize and disconnect nonelectrical equipment for removal by others.
2. Where shown, de-energize, disconnect, and remove electrical equipment.

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3. Remove affected circuits and raceways back to serving panelboard or control panel. Where affected circuits are consolidated with others, remove raceways back to first shared condulet or box. Where underground or embedded raceways are to be abandoned, remove raceway to 1 inch below surface of structure or 12 inches belowgrade and restore existing surface.

B. Provide temporary power as required per Section 01 31 13, Project Coordination.

3.03 PROTECTION FOLLOWING INSTALLATION

A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation.

B. Cap conduit runs during construction with manufactured seals.

C. Close openings in boxes or equipment during construction.

D. Energize space heaters furnished with equipment.

3.04 DEVICE BOXES

A. Install suitable for conditions encountered at each device in wiring or raceway system, sized to meet NFPA 70 requirements.

B. Size:

1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
2. Single Gang: Minimum 2-inch by 4-inch sheet steel device box.

C. Locations:

1. Drawing locations are approximate.
2. To avoid interference with mechanical equipment or structural features, relocate devices as directed by Owner.

D. Mounting Height:

1. General:
   a. Dimensions given to centerline of box.
   b. Where specified heights do not suit building construction or finish, mount as directed by Owner.
2. Switches and Push-buttons: 48 inches above floor.

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E. Install plumb and level.

F. Support boxes independently of conduit by attachment to building structure or structural member.

G. Box Type, Corrosive Locations (PVC-Coated rigid Galvanized Steel Raceway System): PVC-coated cast metal with matching cover.

3.05 JUNCTION AND PULL BOXES

A. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.

B. Install pull boxes where necessary in raceway system to facilitate conductor installation.

C. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.

D. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.

E. Use conduit bodies as junction and pull boxes where no splices are required and their use is allowed by applicable codes.

F. Installed boxes shall be accessible.

G. Do not install on finished surfaces.

H. Install plumb and level.

I. Support boxes independently of conduit by attachment to building structure or structural member.

J. Mounting Hardware:

1. Noncorrosive Indoor Dry Areas: Galvanized.
2. Outdoor or Noncorrosive Indoor Wet Areas: Stainless steel.
3. Corrosive Areas: Stainless steel.

K. Install Drain/breather fittings in NEMA 250, Type 4 and Type 4X enclosures.

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3.06 WIRING DEVICES

A. Receptacles:

1. Install with grounding slot down.
2. Weatherproof Receptacles: Install such that hinge for protective cover is above receptacle opening.

B. Control Stations:

1. Mounting Height: See Article Device Boxes.
2. Install with switch operation in vertical position.

3.07 DEVICE PLATES

A. Securely fasten to wiring device; ensure a tight fit to box.

B. Surface Mounted: Plate shall not extend beyond sides of box, unless plates have no sharp corners or edges.

C. Install with alignment tolerance to box of 1/16 inch.

D. Types (Unless Otherwise Shown):

1. Outdoor: Weatherproof.
2. Indoor:
   a. Surface Mounted, Metal Boxes: Cast.

3.08 TERMINAL BLOCKS

A. Install for termination of control circuits entering or leaving equipment and local control panels.

3.09 SUPPORT AND FRAMING CHANNELS

A. Install where required for mounting and supporting electrical equipment and raceway systems.

B. Channel Type:

1. Interior, Dry or Dry Noncorrosive Locations: Carbon steel.
2. Interior, Wet or Dry Corrosive Locations: Type 316 stainless steel.
3. Outdoor, Noncorrosive Locations: Carbon steel.
4. Outdoor, Corrosive Locations: Type 316 stainless steel.

C. Paint carbon steel channel cut ends prior to installation with zinc-rich primer.

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3.10 NAMEPLATES

A. Provide identifying nameplate on all equipment.

3.11 CONDUIT AND FITTINGS

A. General:

1. Crushed or deformed raceways not permitted.
2. Maintain raceway entirely free of obstructions and moisture.
3. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.
4. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.
5. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box, and drain fitting at conduit low point.
6. Group raceways installed in same area.
7. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.
8. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.
9. Block Walls: Do not install raceways in same horizontal course with reinforcing steel.
10. Install watertight fittings in outdoor, underground, or wet locations.
11. Paint threads and cut ends, before assembly of fittings, galvanized conduit, PVC-coated galvanized conduit, or IMC installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.
12. Metal conduit to be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.
13. Do not install raceways in concrete equipment pads, foundations, or beams.
14. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.
15. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.
16. Install conduits for fiber optic cables, telephone cables, and Category 5 data cables in strict conformance with the requirements of EIA/TIA 569.

B. Conduit Application:

1. Diameter Minimum 3/4 inch.

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2. Outdoor, Exposed:
   a. Rigid galvanized steel.
   b. PVC-coated rigid galvanized steel.
3. Indoor, Exposed:
   a. Rigid galvanized steel.
   b. PVC-coated rigid galvanized steel.
4. Under Slabs-On-Grade: PVC-coated rigid galvanized steel.
5. Corrosive Areas: PVC-coated rigid galvanized steel.
6. Classified Areas:
   a. Rigid galvanized steel.
   b. PVC-coated rigid galvanized steel.

C. Connections:

1. For motor-mounted, wall-mounted, or ceiling-mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other equipment where flexible connection is required to minimize vibration:
   a. General: Flexible metal, liquid-tight conduit.
   b. Hazardous Areas: Flexible coupling suitable for Class I, Division 1 and 2 areas.
   c. Wet or Corrosive Areas: Flexible metal liquid-tight.
   d. Length: 18 inches minimum, 60 inches maximum, sufficient to allow movement or adjustment of equipment.
2. Lighting Fixtures in Dry Areas: Flexible metal, liquid-tight conduit.
3. Outdoor areas, process areas exposed to moisture, and areas required to be oiltight and dust-tight: Flexible metal, liquid-tight conduit.
4. Transition from Underground or Concrete Embedded to Exposed: PVC-coated rigid steel conduit.
5. Under Equipment Mounting Pads: PVC-coated rigid steel conduit.
6. Exterior Light Pole Foundations: Rigid galvanized steel or PVC-coated rigid steel conduit.

D. Penetrations:

1. Make at right angles, unless otherwise shown.
2. Notching or penetration of structural members, including footings and beams, not permitted.
3. Fire-Rated Walls, Floors, or Ceilings: Firestop openings around penetrations to maintain fire-resistance rating using fire penetration seals.
4. Concrete Walls, Floors, or Ceilings (Aboveground): Provide nonshrink grout dry-pack.

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5. Entering Structures:
    a. General: Seal raceway at the first box or outlet with oakum or expandable plastic compound to prevent the entrance of gases or liquids from one area to another.
    b. Concrete Roof or Membrane Waterproofed Wall or Floor: Provide watertight seal.
    c. Heating, Ventilating, and Air Conditioning Equipment:
        1) Penetrate equipment in area established by manufacturer.
        2) Terminate conduit with flexible metal conduit at junction box or condulet attached to exterior surface of equipment prior to penetrating equipment.
        3) Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.
    d. Corrosive-Sensitive Areas:
        1) Seal conduit entering equipment panelboards and field panels containing electronic equipment.
        2) Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.
    e. Existing or Precast Wall (Underground): Core drill wall and install watertight entrance seal device.

E. Support:

1. Support from structural members only, at intervals not exceeding NFPA 70 requirements, and in any case not exceeding 10 feet. Do not support from piping, pipe supports, or other raceways.
2. Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit, allow 20 percent extra space for future conduit.
3. Application/Type of Conduit Strap:
    a. Steel Conduit: Zinc-coated steel, pregalvanized steel, or malleable iron.
    b. PVC-Coated Rigid Steel Conduit: PVC-coated metal.
    c. Nonmetallic Conduit: Nonmetallic or PVC-coated metal.
4. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:
    a. Wood: Wood screws.
    b. Hollow Masonry Units: Toggle bolts.
    c. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
    d. Steelwork: Machine screws.
    e. Location/Type of Hardware:
        1) Dry, Noncorrosive Areas: Galvanized.

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2) Wet, Noncorrosive Areas: Stainless steel.
3) Corrosive Areas: Stainless steel.

F. Bends:

1. Install concealed raceways with a minimum of bends in the shortest practical distance.
2. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches minimum.
3. Install with symmetrical bends or cast metal fittings.
4. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.
5. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.
6. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run and raceways are same size.
7. PVC Conduit:
   a. Bends 30 Degrees and Larger: Provide factory-made elbows.
   b. Use manufacturer's recommended method for forming smaller bends.
8. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

G. Expansion and Deflection Fittings: Provide on all raceways at structural expansion joints and in long tangential runs.

H. PVC-Coated Rigid Steel Conduit:

1. Install in accordance with manufacturer's instructions.
2. All tools and equipment used in the cutting, bending, threading, and installation of PVC-coated rigid steel conduit shall be designed to limit damage to the PVC coating.
3. Provide PVC boot to cover all exposed threading.

I. Termination at Enclosures:

1. Cast Metal Enclosure: Provide manufacturer's premolded insulating sleeve inside metallic conduit terminating in threaded hubs.
2. Sheet Metal Boxes, Cabinets, and Enclosures:
   a. In Wet or damp areas, no top entry penetrations are allowed. Conduit entry shall be through the either the sides or bottom.

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b. Rigid Galvanized Conduit:
   1) Provide one lock nut each on inside and outside of enclosure.
   2) Install grounding bushing.
   3) Provide bonding jumper from grounding bushing to equipment ground bus or ground pad; if neither ground bus nor pad exists, connect jumper to lag bolt attached to metal enclosure.
   4) Install insulated bushing on ends of conduit where grounding is not required.
   5) Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
   6) Terminate conduits with threaded conduit hubs at NEMA 4 and 4X boxes and enclosures.

c. Flexible Metal Conduit: Provide two-screw type, insulated, malleable iron connectors.

d. PVC-Coated Rigid Galvanized Steel Conduit: Provide PVC-coated, liquid-tight, metallic connector.

3. Free-Standing Enclosures:
   a. Terminate metal conduit entering bottom with grounding bushing; provide a grounding jumper extending to equipment ground bus or grounding pad.
   b. Terminate PVC conduit entering bottom with bell end fittings.

J. Identification Devices:

1. Raceway Tags:
   a. Identify origin and destination.
   b. Install at each terminus, near midpoint, and at minimum intervals of every 50 feet of exposed raceway, whether in ceiling space or surface mounted.
   c. Provide corrosion-resistant wire for attachment.

K. Raceway Band: Install wherever metallic conduit emerges from concrete slabs. Not required with PVC-coated RGS conduit. Center band at slab surface and install according to manufacturer's instructions.

1. Slip-on Type: Clean conduit surface at installation location. Cut tubing to 4-inch minimum lengths and slip onto raceway prior to slab placement and termination of conduit. Heat-shrink onto conduit.
2. Wrap-around Type: Use where slip-on access to conduit is not possible. Clean conduit surface at installation location. Apply primer. Apply wraps to provide two layers of tape. Neatly finish tape end to prevent unraveling.

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3.12 CONDUCTORS AND CABLES

A. Conductor storage, handling, and installation shall be in accordance with manufacturer's recommendations.

B. Do not exceed manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

C. Conduit system shall be complete prior to drawing conductors. Lubricate prior to pulling into conduit. Lubrication type shall be as approved by conductor manufacturer.

D. Terminate all conductors and cables, unless otherwise shown.

E. Do not splice conductors, unless specifically indicated or approved by Engineer.

F. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 12 inches.

G. Wiring within Equipment and Local Control Panels: Remove surplus wire, dress, bundle, and secure.

H. Power Conductor Color Coding:

1. No. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering an area 1-1/2 inches to 2 inches wide.
2. No. 8 AWG and Smaller: Provide colored conductors.
3. Colors:
    a. Neutral Wire: White.
    b. Live Wires, 120/240-Volt, Single-Phase System: Black, red.
    c. Live Wires, 120/208-Volt, Three-Phase System: Black, red, or blue.
    d. Live Wires, 277/480-Volt, Three-Phase System: Brown, orange, or yellow.
    e. Ground Wire: Green.

I. Circuit Identification:

1. Circuits Appearing in Circuit Schedules: Identify power, instrumentation, and control conductor circuits, using circuit schedule designations, at each termination and in accessible locations such as

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manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.

2. Circuits Not Appearing in Circuit Schedules: Assign circuit name based on device or equipment at load end of circuit. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.
3. Method: Identify with sleeves. Taped-on markers or tags relying on adhesives not permitted.

J. Connections and Terminations:

1. Install wire nuts only on solid conductors.
2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control circuit conductors.
3. Tape insulate all uninsulated connections.
4. Install crimp connectors and compression lugs with tools approved by connector manufacturer.

3.13 GROUNDING

A. Grounding shall be in compliance with NFPA 70 and as shown.

B. Ground each separately derived system neutral to nearest effectively grounded building structural steel member or separate grounding electrode.

C. Bond together system neutrals, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.

D. Shielded Instrumentation Cables:

1. Ground shield to ground bus at power supply for analog signal.
2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
3. Do not ground instrumentation cable shield at more than one point.

E. Equipment Grounding Conductors: Provide in all conduits containing power conductors and control circuits above 50 volts.

3.14 MOTOR CONTROL CENTERS

A. Install equipment in accordance with NEMA ICS 2.3 and manufacturer’s instructions and recommendations.

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B. Field adjust trip settings of motor starter magnetic-trip-only circuit breakers. Adjust to approximately 11 times motor rated current.

C. Select and install overload relay heaters or adjust electronic overload protection after the actual nameplate full-load current rating of motor has been determined.

3.15 FIELD QUALITY CONTROL

A. Tests shall be performed in accordance with the requirements of Section 01 91 14, Equipment Testing and Facility Startup.

B. General:

1. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.
2. Test instrument calibration shall be in accordance with NETA ATS.
3. Perform inspection and electrical tests after equipment has been installed.
4. Perform tests with apparatus de-energized whenever feasible.
5. Inspection and electrical tests on energized equipment are to be:
    a. Scheduled with Owner prior to de-energization.
    b. Minimized to avoid extended period of interruption to the operating plant equipment.

C. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer’s tolerances.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70.

D. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer’s recommendations.

E. Set, test, and calibrate protective relays, circuit breakers and other applicable devices in accordance with values established by short circuit, coordination, and harmonics studies as specified in Section 26 05 70, Electrical Systems Analysis.

F. Adjust mechanisms and moving parts for free mechanical movement.

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G. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

H. Verify nameplate data for conformance to Contract Documents.

I. Realign equipment not properly aligned and correct unlevelness.

J. Properly anchor electrical equipment found to be inadequately anchored.

K. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.

L. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

M. Provide proper lubrication of applicable moving parts.

N. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

O. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by Engineer, door and panel sections having damaged surfaces.
5. Replace missing or damaged hardware.

P. Provide certified test report(s) documenting the successful completion of specified testing. Include field test measurement data.

Q. Test the following equipment and materials:

1. Conductors:
    a. Visual and Mechanical Inspection:
        1) Inspect each individual exposed power cable No. 4 and larger for:
            a) Physical damage.

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b) Proper connections in accordance with single-line diagram.
c) Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
d) Color coding conformance with specification.
e) Proper circuit identification.

2) Mechanical Connections for:
a) Proper lug type for conductor material.
b) Proper lug installation.
c) Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.

3) Shielded Instrumentation Cables for:
a) Proper shield grounding.
b) Proper terminations.
c) Proper circuit identification.

4) Control Cables for:
a) Proper termination.
b) Proper circuit identification.

5) Cables Terminated Through Window Type CTs: Verify neutrals and grounds are terminated for correct operation of protective devices.

b. Electrical Tests for Conductors No. 4 and Larger:
1) Insulation Resistance Tests:
a) Utilize 1,000-volt dc megohmmeter for 600-volt insulated conductors and 500-volt dc megohmmeter for 300-volt insulated conductors.
b) Test each conductor with respect to ground and to adjacent conductors for 1 minute.
c) Evaluate ohmic values by comparison with conductors of same length and type.
d) Investigate values less than 50 megohms.

2) Continuity test by ohmmeter method to ensure proper cable connections.

2. Switches:
a. Visual and Mechanical Inspection:
1) Proper blade pressure and alignment.
2) Proper operation of switch operating handle.
3) Adequate mechanical support for each fuse.
4) Proper contact-to-contact tightness between fuse clip and fuse.
5) Cable connection bolt torque level in accordance with NETA ATS, Table 100.12.
6) Proper phase barrier material and installation.

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7) Verify fuse sizes and types correspond to one-line diagram or approved Submittals.
8) Perform mechanical operational test.

b. Electrical Tests:
1) Insulation Resistance Tests:
a) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
b) Phase-to-phase and phase-to-ground for 1 minute on each pole.
c) Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2) Contact Resistance Tests:
a) Contact resistance in microhms across each switch blade and fuse holder.
b) Investigate deviation of 50 percent or more from adjacent poles or similar switches.

3. Motor controls:
a. Visual and Mechanical Inspection:
1) Proper barrier and shutter installation and operation.
2) Proper operation of indicating and monitoring devices.
3) Proper overload protection for each motor.
4) Improper blockage of air-cooling passages.
5) Proper operation of drawout elements.
6) Integrity and contamination of bus insulation system.
7) Check door and device interlocking system by:
a) Closure attempt of device when door is in OPEN position.
b) Opening attempt of door when device is in CLOSED position.
8) Check nameplates for proper identification of: Equipment title and tag number with latest one-line diagram.
9) Verify fuse and circuit breaker sizes and types conform to Contract Documents.
10) Verify current and potential transformer ratios conform to Contract Documents.
11) Check bus connections for high resistance by thermographic survey:
a) Thermographic survey temperature gradient of 2 degrees C, or less per NETA ATS, Table 100.18
12) Check operation and sequencing of electrical and mechanical interlock systems by:
a) Closure attempt for locked open devices.
b) Opening attempt for locked closed devices.

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13) Verify performance of each control device and feature furnished as part of motor control center.
14) Control Wiring:
    a) Compare wiring to local and remote control, and protective devices with elementary diagrams.
    b) Check for proper conductor lacing and bundling.
    c) Check for proper conductor identification.
    d) Check for proper conductor lugs and connections.
15) Exercise active components.
16) Inspect contactors for:
    a) Correct mechanical operations.
    b) Correct contact gap, wipe, alignment, and pressure.
    c) Correct torque of connections.
17) Compare overload heater rating with full-load current for proper size.
18) Compare fuse, motor protector and circuit breakers with motor characteristics for proper size.
19) Perform phasing check on double-ended motor control centers to ensure proper bus phasing from each source.

b. Electrical Tests:
1) Insulation Resistance Tests:
    a) Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
    b) Bus section phase-to-phase and phase-to-ground for 1 minute on each phase.
    c) Contactor phase-to-ground and across open contacts for 1 minute on each phase.
    d) Starter section phase-to-phase and phase-to-ground on each phase with starter contacts closed and protective devices open.
    e) Test values to comply with NETA ATS, Table 100.1.
2) Current Injection through Overload Unit at 300 Percent of Motor Full-Load Current and Monitor Trip Time:
    a) Trip time in accordance with manufacturer’s published data.
    b) Investigate values in excess of 120 seconds.
3) Control Wiring Tests:
    a) Apply secondary voltage to control power and potential circuits.
    b) Check voltage levels at each point on terminal board and each device terminal.

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c) Insulation resistance test at 1,000 volts dc on control wiring, except that connected to solid state components; 1 megohm minimum insulation resistance.

4) Operational test by initiating control devices to affect proper operation.

4. Grounding:
   a. Visual and Mechanical Inspection:
      1) Equipment and circuit grounds in motor control center, and panelboard assemblies for proper connection and tightness.
      2) Ground bus connections in motor control center and panelboard assemblies for proper termination and tightness.
   b. Electrical Tests:
      1) Fall of Potential Test:
         a) In accordance with IEE 81, Section 8.2.1.5 for measurement of main ground system's resistance.
         b) Main ground electrode system resistance to ground to be no greater than 5 ohms.
      2) Two Point Direct Method Test:
         a) In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames, and system neutral and derived neutral points.
         b) Equipment ground resistance shall not exceed main ground system resistance by 0.25 ohms.
5. Motors:
   a. Visual and Mechanical Inspection:
      1) Proper electrical and grounding connections.
      2) Shaft alignment.
      3) Blockage of ventilating air passageways.
      4) Operate motor and check for:
         a) Excessive mechanical and electrical noise.
         b) Overheating.
         c) Correct rotation.
         d) Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionability and proper operation.
         e) Excessive vibration, in excess of values in NETA ATS, Table 100.10.
      5) Check operation of space heaters.

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b. Electrical Tests:
1) Insulation Resistance Tests:
a) In accordance with IEEE 43 at test voltages established by NETA ATS, Table 100.1 for:
(1) Motors above 200 horsepower for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
(2) Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 seconds and 60 seconds.
b) Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.
2) Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.
3) Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.

6. Light fixtures and receptacles.
a. Functionally test each device for the entire circuit of those replaced.

R. Controls:

1. Test control and signal wiring for proper termination and function.
2. Test local control panels and other control devices for proper terminations, configuration and settings, and functions.
3. Demonstrate control, monitoring, and indication functions in presence of Owner and Engineer.

S. Equipment Line Current: Check line current in each phase for each piece of equipment.

END OF SECTION

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SECTION 26 05 70
ELECTRICAL SYSTEMS ANALYSIS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C57.12.00, Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
   b. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
   c. 399, Recommended Practice for Industrial and Commercial Power System Analysis.
   d. 519, Recommended Practices and requirements for Harmonic Control in Electrical Power Systems.
   e. 1584, Guide for Performing Arc Flash Hazard Calculations, 2018 edition.
3. National Electrical Manufacturers Association (NEMA): Z535.4, Product Safety Signs and Labels.
4. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 70E, Standard for Electrical Safety in the Workplace.
5. Occupational Safety and Health Standards (OSHA): 29 CFR, Part 1910 Subpart S, Electrical.

1.02 SUBMITTALS

A. Action Submittals (refer to Article Sequencing and Scheduling):

1. Short circuit study.
2. Protective Device Coordination Study.
3. Final Protective Device Coordination Study.
4. Arc Flash Study.
5. Arc flash warning labels.
6. Electronic files on USB flash drive of final studies including all engineering software input files, output reports, and libraries.

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1.03 QUALITY ASSURANCE

A. Short circuit and protective device coordination and arc flash] studies shall be prepared by a professional electrical engineer registered in the State of Oregon.

1.04 SEQUENCING AND SCHEDULING

A. Final short circuit, protective device coordination, and arc flash studies shall be completed and implemented prior to reenergizing equipment. Final version of study shall include as-installed equipment, materials, and parameter data or settings entered into equipment based on initial study.

B. Submit final arc flash labels prior to approved Facility Performance Demonstration/Certificates, per Section 01 91 14, Equipment Testing and Facility Startup.

1.05 GENERAL STUDY REQUIREMENTS

A. Equipment and component titles used in the studies shall be identical to equipment and component titles shown on Drawings.

B. Perform studies using one of the following electrical engineering software packages:

1. SKM Power Tools for Windows.
2. ETAP.
3. Paladin.
4. Easy Power.

C. Perform complete fault calculations for each existing and proposed source combination.

1. Source combination may include present and future power company supply circuits, double ended systems, large motors, or generators.

D. Utilize proposed and existing load data for study obtained from Contract Documents. Any required information not shown on the contract document shall be obtained from field investigation of system.

E. Existing System and Equipment:

1. Extent of existing system to be included in study is all of the existing system and equipment starting from the first overcurrent protective

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device on the line side of MCC-4A&B to each load, including all loads at MCC-7A&B.
2. Include fault contribution of existing motors and equipment in study.
3. Include impedance elements that affect new system and equipment.
4. Include protective devices in series with new equipment.

F. Device coordination time-current curves for low voltage distribution system; include individual protective device time-current characteristics.

1.06 SHORT CIRCUIT STUDY

A. General:

1. Prepare in accordance with IEEE 399.
2. Use cable impedances based on copper conductors, except where aluminum conductors are specified or shown.
3. Use bus impedances based on copper bus bars, except where aluminum bus bars are specified or shown.
4. Use cable and bus resistances calculated at 25 degrees C.
5. Use medium-voltage cable reactances based on use of typical dimensions of shielded cables with 133 percent insulation levels.
6. Use 600-volt cable reactances based on use of typical dimensions of XHHW conductors.
7. Use transformer impedances 92.5 percent of “nominal” impedance based on tolerances specified in IEEE C57.12.00.

B. Provide:

1. Calculation methods and assumptions.
2. Typical calculation.
3. Tabulations of calculated quantities.
4. Results, conclusions, and recommendations.
5. Selected base per unit quantities.
6. One-line diagrams.
7. Source impedance data, including electric utility system and motor fault contribution characteristics.
8. Impedance diagrams.
9. Zero-sequence impedance diagrams.

C. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed three-phase bolted fault at each:

1. Motor control centers.
2. Branch circuit panelboards.
3. Motor Starting equipment include Combination starters, VFDs RVSS.

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4. Safety disconnect switches.
5. Future load contributions as shown on one-line diagram.

D. Provide bolted line-to-ground fault current study for areas as defined for three-phase bolted fault short circuit study.

E. Verify:

1. Equipment and protective devices are applied within their ratings.
2. Adequacy of motor control centers bus bars to withstand short circuit stresses.
3. Cable and busway sizes for ability to withstand short circuit heating, in addition to normal load currents.

F. Tabulations:

1. General Data:
   a. Short circuit reactances of rotating machines.
   b. Cable and conduit material data.
   c. Bus data.
   d. Transformer data.
   e. Circuit resistance and reactance values.
2. Short Circuit Data (for each source combination):
   a. Fault impedances.
   b. X to R ratios.
   c. Asymmetry factors.
   d. Motor contributions.
   e. Short circuit kVA.
   f. Symmetrical and asymmetrical fault currents.
3. Equipment Evaluation:
   a. Equipment bus bracing, equipment short circuit rating, transformer, cable, busway.
   b. Maximum fault current available.

G. Written Summary:

1. Scope of studies performed.
2. Explanation of bus and branch numbering system.
3. Prevailing conditions.
4. Selected equipment deficiencies.
5. Results of short circuit study.
6. Comments or suggestions.

H. Suggest changes and additions to equipment rating and/or characteristics.

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I. Notify Owner in writing of existing circuit protective devices improperly rated for new fault conditions.

J. Revise data for “as-installed” condition.

1.07 PROTECTIVE DEVICE COORDINATION STUDY

A. General:

1. Prepare in accordance with IEEE 242.
2. Proposed protective device coordination time-current curves for distribution system, graphically displayed on conventional log-log curve sheets.
    a. Provide separate curve sheets for phase and ground fault coordination for each scenario.
    b. Each curve sheet to have title and one-line diagram that applies to specific portion of system associated with time-current curves on that sheet. Limit number of devices shown to four to six.
    c. Identify device associated with each curve by manufacturer type, function, and, if applicable, recommended tap, time delay, instantaneous and other settings recommended.
    d. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.
    e. Apply motor protection methods that comply with NFPA 70.

B. Plot Characteristics on Curve Sheets:

1. Low-voltage fuses including manufacturer’s minimum melt, total clearing, tolerance, and damage bands.
2. Low-voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
3. Pertinent transformer full-load currents at 100 percent.
4. Transformer magnetizing inrush currents.
5. Transformer damage curves; appropriate for system operation and location.
6. ANSI transformer withstand parameters.
7. Significant symmetrical and asymmetrical fault currents.
8. Motor overload relay settings for motors greater than 40 hp.
9. Ground fault protective device settings.
10. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center.

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C. Primary Protective Device Settings for Delta-Wye Connected Transformer:

1. Secondary Line-to-Ground Fault Protection: Primary protective device operating band within transformer's characteristics curve, including a point equal to 58 percent of IEEE C57.12.00 withstand point.
2. Secondary Line-to-Line Faults: 16 percent current margin between primary protective device and associated secondary device characteristic curves.

D. Tabulate Recommended Protective Device Settings:

1. Relays:
   a. Current tap.
   b. Time dial.
   c. Instantaneous pickup.
   d. Electronic settings data file.
2. Circuit Breakers:
   a. Adjustable pickups.
   b. Adjustable time-current characteristics.
   c. Adjustable time delays.
   d. Adjustable instantaneous pickups.
   e. I^2t In/Out.
   f. Zone interlocking.
   g. Electronic settings data file.

E. Written Summary:

1. Scope of studies performed.
2. Summary of protective device coordination methodology.
3. Prevailing conditions.
4. Selected equipment deficiencies.
5. Results of coordination study.
6. Appendix of complete relay and circuit breaker electronic setting files submit electronic data files from manufacturer's software.
7. Comments or suggestions.

1.08 ARC FLASH STUDY

A. Perform arc flash hazard study after short circuit and protective device coordination study has been completed, reviewed, and accepted.

B. Perform arc flash study in accordance with NFPA 70E, OSHA 29 CFR, Part 1910 Subpart S, and IEEE 1584.

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C. Base Calculation:

1. For each major part of electrical power system, determine the following:
   a. Flash hazard protection boundary.
   b. Limited approach boundary.
   c. Restricted approach boundary.
   d. Incident energy level.
   e. Glove class required.

D. Produce arc flash warning labels that list items in Paragraph Base Calculation and the following additional items.

1. Bus name.
2. Bus voltage.

E. Produce bus detail sheets that list items in Paragraph Base Calculation and the following additional items:

1. Bus name.
2. Upstream protective device name, type, and settings.
3. Bus line-to-line voltage.

F. Produce arc flash evaluation summary sheet listing the following additional items:

1. Bus name.
2. Upstream protective device name, type, settings.
3. Bus line-to-line voltage.
4. Bus bolted fault.
5. Protective device bolted fault current.
6. Arcing fault current.
7. Protective device trip/delay time.
8. Breaker opening time.
9. Solidly grounded column.
10. Equipment type.
11. Gap.
12. Arc flash boundary.
13. Working distance.
14. Incident energy.

G. Analyze short circuit, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated or causes incident energy values greater than 8 cal/cm^2. Propose approaches to reduce energy levels.

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H. Prepare report summarizing arc flash study with conclusions and recommendations which may affect integrity of electric power distribution system. As a minimum, include the following:

1. Equipment manufacturer's information used to prepare study.
2. Assumptions made during study.
3. Reduced copy of one-line drawing; 11 inches by 17 inches maximum.
4. Arc flash evaluations summary spreadsheet.
5. Bus detail sheets.
6. Arc flash warning labels printed in color on thermally bonded adhesive backed UV and weather-resistant labels.

PART 2 PRODUCTS

2.01 ARC FLASH WARNING LABELS

A. Compliance with NEMA Z535.4.

B. Arc flash warning labels printed in color on thermally bonded adhesive backed, UV- and weather-resistant labels. An example label is located following end of section in Figure 1.

PART 3 EXECUTION

3.01 GENERAL

A. Adjust relay and protective device settings according to values established by coordination study.

B. Make minor modifications to proposed equipment as required to accomplish conformance with short circuit and protective device coordination studies.

C. Notify Owner in writing of required major equipment modifications.

D. Provide arc flash warning labels on the following equipment:

1. Motor control centers.
2. Panelboards.
3. Standby generator main breaker.
4. Control cabinets fed by 120V or greater.
5. Equipment requiring servicing, adjustment, or inspection while energized.

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3.02 SUPPLEMENTS

A. The supplement listed below, following “End of Section,” is a part of this Specification:

1. Figure 1: Example Arc Flash Label.

END OF SECTION

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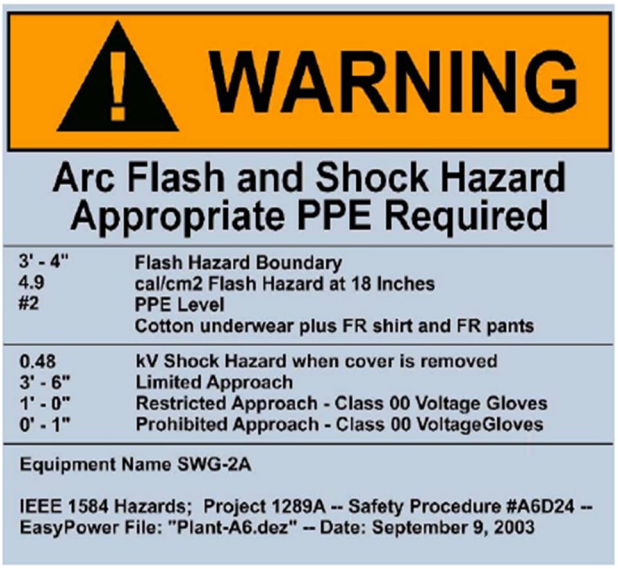

Figure 1
Example Arc Flash Label

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SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
   b. A313/A313M, Standard Specification for Stainless Steel Spring Wire.
   c. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   d. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
   e. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
   f. A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   g. A780, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
   h. A824, Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
   i. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   j. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   k. C150, Standard Specification for Portland Cement.
   l. C387, Standard Specifications for Packaged, Dry, Combined Materials for Mortar and Concrete.
   m. F552, Standard Terminology Relating to Chain Link Fencing.
   n. F567, Standard Practice for Installation of Chain-Link Fence.
   o. F626, Standard Specification for Fence Fittings.
   p. F668, Standard Specification for Polyvinyl Chloride (PVC) and Other Organic Polymer-Coated Steel Chain-Link Fence Fabric.
   q. F900, Standard Specification for Industrial and Commercial Swing Gates.
   r. F934, Standard Specification for Standard Colors for Polymer-Coated Chain Link Fence Materials.

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s. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
t. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
u. F1183, Standard Specifications for Aluminum Alloy Chain Link Fence Fabric.
v. F1184, Standard Specifications for Industrial and Commercial Horizontal Slide Gates.
w. F1379, Standard Terminology Relating to Barbed Tape.
x. F1911, Standard Practice for Installation of Barbed Tape.
y. F1916, Standard Specification for Selecting Chain Link Barrier Systems with Coated Chain Link Fence Fabric and Round Posts for Detention Applications.

2. Institute of Electrical and Electronic Engineers (IEEE), Inc.: C2, National Electrical Safety Code.
3. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 volts max.).

1.02 DEFINITIONS

A. Terms as defined in ASTM F552.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product Data: Include construction details, material descriptions, dimensions of individual components, and finishes for chain link fences and gates.
      1) Fence, gate posts, rails, and fittings.
      2) Chain link fabric.
      3) Gates and hardware.
      4) Accessories: Barbed wire.
2. Test Reports: Field test result for compliance of installation of chain link fence, gates, and gate operators.

B. Informational Submittals:

1. Manufacturer’s recommended installation instructions.
2. Evidence of Supplier and installer qualifications.
3. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

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1.04 QUALITY ASSURANCE

A. Design, supply of equipment and components, installation, and on-call service shall be product of individual company with record of installations meeting requirements specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.06 SCHEDULING AND SEQUENCING

A. Complete necessary Site preparation and grading before installing chain link fence and gates.

B. Interruption of Existing Utility Service: Notify owner of utility 72 hours prior to interruption of utility services. Do not proceed with interruption of utility service without written permission from utility owner.

1.07 SPECIAL GUARANTEE

A. Provide manufacturer’s extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of the following items found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Deflection of fence fabric beyond limits.

PART 2 PRODUCTS

2.01 GENERAL

A. Match style, finish, and color of each fence component with that of other fence components.

2.02 CHAIN LINK FENCE FABRIC

A. Galvanized fabric conforming to ASTM A392, Type II, Class 2, 2.0 ounces per square foot; galvanized before weaving.

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B. Height: 72 inches, unless otherwise shown.

C. Core Wire Gauge: No. 11.

D. Pattern: 2-inch diamond-mesh.

E. Diamond Count: Manufacturer’s standard and consistent for fabric furnished of same height.

F. Loops of Knuckled Selvages: Closed or nearly closed with space not exceeding diameter of wire.

G. Wires of Twisted Selvages:

1. Twisted in a closed helix three full turns.
2. Cut at an angle to provide sharp barbs that extend minimum 1/4 inch beyond twist.

2.03 POSTS

A. General:

1. Strength and Stiffness Requirements: ASTM F1043, light industrial fence, except as modified in this section.
2. Round Steel Pipe: Domestic CR40 electric welded pipe, ASTM F1043, 50,000 psi high carbon steel, AASHTO M181 Type 2.
3. Roll-Formed Steel Shapes: Roll-formed from ASTM A1011/A1011M, Grade 45, High-Strength Low-Alloy steel.
4. Lengths: Manufacturer’s standard with allowance for minimum embedment below finished grade of 34 inches.
5. Protective Coatings:
   a. Zinc Coating: ASTM F1043, Type A external and internal coating.

B. Posts for Swing Gates 8 Feet High and Under:

1. ASTM F900.
2. Round Steel Pipe:
   a. Outside Diameter: 6.625 inches.
   b. Weight: 18.02 pounds per foot.

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C. Line Posts:

1. Round Steel Pipe:
   a. Outside Diameter: 2.375 inches.
   b. Weight: 2.96 pounds per foot.

D. End, Corner, Angle, and Pull Posts:

1. Round Steel Pipe:
   a. Outside Diameter: 2.875 inches.
   b. Weight: 4.69 pounds per foot.

2.04 TOP AND BRACE RAILS

A. Galvanized Round Steel Pipe:

1. ASTM F1083.
2. Outside Diameter: 1.66 inches.
3. Weight: 2.27 pounds per foot.

B. Galvanized Roll-Formed Steel C Shapes:

1. Roll formed from ASTM A1011/A1011M, Grade 45.
2. Outside Dimensions: 1.625 inches by 1.25 inches.
3. Weight: 1.40 pounds per foot.

C. Protective Coatings: As specified for posts.

D. Strength and Stiffness Requirements: ASTM F1043, top rail, heavy or light industrial fence.

2.05 FENCE FITTINGS

A. General: In conformance with ASTM F626, except as modified by this article.

B. Post and Line Caps: Designed to accommodate passage of top rail through cap, where top rail required.

C. Tension and Brace Bands: No exceptions to ASTM F626.

D. Tension Bars:

1. One-piece.

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2. Length not less than 2 inches shorter than full height of chain link fabric.
3. Provide one bar for each gate and end post, and two for each corner and pull post.

E. Truss Rod Assembly: 3/8-inch diameter, steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

F. Tie Wires, Clips, and Fasteners: According to ASTM F626.

G. Barbed Wire Supporting Arms: Aluminum Alloy 360 with clips, slots, or other means for attaching strands of barbed wire integral with post cap for each post, with single 45-degree arms for supporting three strands of barbed wire. Arms shall withstand 250 pounds of downward pull at outermost ends of the arms without failure.

2.06 TENSION WIRE

A. Zinc-coated steel marcelled tension wire conforming to ASTM A824 Type II, Class 2.

2.07 BARBED WIRE

A. Zinc-Coated Barbed Wire: ASTM A121, Chain Link Fence Grade.

B. Aluminum-Coated Steel Barbed Wire: ASTM A121, Type I.

1. Line Wire: Two strands of No. 12-1/2 gauge.
2. Barbs:
   a. Number of Points: Four.
   b. Length: 3/8 inch minimum.
   c. Shape: Round.
   d. Diameter: No. 14 gauge.
   e. Spacing: 5 inches.

2.08 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

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B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel.

PART 3 EXECUTION

3.01 GENERAL

A. Install chain link fences and gates in accordance with ASTM F567, except as modified in this section, and in accordance with fence manufacturer's recommendations, as approved by Engineer. Erect fencing in straight lines between angle points.

B. Provide necessary hardware for a complete fence and gate installation.

C. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A780.

3.02 PREPARATION

A. Clear area on either side of fence to the extent specified. Eliminate ground surface irregularities along fence line to the extent necessary to maintain a 2-inch clearance between bottom of fabric and finish grade.

B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

C. Embedment Coating: Coat portion of galvanized or aluminum-coated steel posts that will be embedded in concrete as specified in Section 09 90 00, Painting and Coating. Extend coating 1 inch above top of concrete.

3.03 POST SETTING

A. Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil. Driven posts are not acceptable. Postholes shall be clear of loose materials. Waste materials from postholes shall be removed from Site or regraded into slopes on Site.

B. Posthole Depth: As shown.

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C. Set posts with minimum embedment below finished grade of 34 inches and with top rail at proper height above finished grade. Verify posts are set plumb, aligned, and at correct height and spacing. Brace posts, as necessary, to maintain correct position and plumbness until concrete sets.

D. Backfill postholes with concrete to 2 inches above finished grade. Vibrate or tamp concrete for consolidation. Protect above ground portion of posts from concrete splatter.

E. Before concrete sets, crown, and finish top of concrete to readily shed water.

F. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

G. Line Posts: Space line posts uniformly at 10 feet on centers between terminal end, corner, and gate posts.

3.04 POST BRACING

A. Install according to ASTM F567, maintaining plumb position, and alignment of fencing. Install braces at gate, end, pull, and corner posts diagonally to adjacent line posts to ensure stability. Install braces on both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric or higher, on fences with top rail, and 2/3-fabric height on fences without top rail. Install so posts are plumb when diagonal truss rod assembly is under proper tension.

3.05 TOP RAILS

A. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or posts caps fabricated to receive rail at terminal posts. Install top rail sleeves with springs at 105 feet maximum spacing to permit expansion in rail.

3.06 BARBED WIRE SUPPORTING ARMS

A. Barbed wire supporting arms shall be installed as indicated and as recommended by manufacturer. Bolt or rivet supporting arm to top of post in a manner to prevent easy removal with hand tools. Angle single arms to outside of fence.

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3.07 TENSION WIRE

A. Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with tie wires at a maximum spacing of 24 inches on center.

B. Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

3.08 CHAIN LINK FABRIC

A. Do not install fabric until concrete has cured minimum 7 days.

B. Install fabric with twisted and barbed selvage at top.

C. Apply fabric to outside of enclosing framework. Pull fabric taut to provide a smooth and uniform appearance free from sag, without permanently distorting fabric diamond or reducing fabric height. Tie fabric to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

D. Splicing shall be accomplished according to ASTM F1916 by weaving a single picket into the ends of the rolls to be joined.

E. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated.

F. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center.

G. Tie Wires: Fasten ties to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends of tie wire three full twists, and cut off protruding ends to preclude untwisting by hand.

1. Maximum Spacing: Tie fabric to line posts at 12 inches on center and to brace and top rails at 24 inches on center.

3.09 BARBED WIRE

A. Install barbed wire uniformly in configurations of three strands of barbed wire on supporting arms. Pull wire taut and install securely to supporting arms and secure to end terminal post or terminal arms.

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3.10 GATES

A. Install gates according to manufacturer's written instructions, level, plumb and secure for full opening without interference. Attach fabric and hardware to gate using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary so gates operate satisfactorily from open or closed position.

B. Set gate stops in concrete to engage center drop rod or plunger bar.

3.11 ELECTRICAL GROUNDING

A. Ground fences at a maximum interval of 1,000 feet in accordance with applicable requirements of IEEE C2, National Electrical Safety Code.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

3.12 FIELD QUALITY CONTROL

A. Post and Fabric Testing: Test fabric tension and line post rigidity according to ASTM F1916.

3.13 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, to train Owner's personnel to adjust, operate, and maintain gates.

3.14 CLEANUP

A. Remove excess fencing materials and other debris from Site.

END OF SECTION

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SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.01 DEFINITIONS

A. Maintenance Period: Begin maintenance immediately after each area is planted and continue for a period of 8 weeks after all planting under this section is completed.

B. Satisfactory Stand:

1. Lawn or section of lawn that has:
   a. No bare spots larger than 3 square feet.
   b. Not more than 10 percent of total area with bare spots larger than 1 square foot.
   c. Not more than 15 percent of total area with bare spots larger than 6 square inches.

1.02 SUBMITTALS

A. Action Submittals: Product labels/data sheets.

B. Informational Submittals:

1. Seed:
   a. Certification of seed analysis, germination rate, and inoculation:
      1) Certify that each lot of seed has been tested by a testing laboratory certified in seed testing, within 6 months of date of delivery. Include with certification:
         a) Name and address of laboratory.
         b) Date of test.
         c) Lot number for each seed specified.
         d) Test Results: (i) name, (ii) percentages of purity and of germination, and (iii) weed content for each kind of seed furnished.
      2) Mixtures: Proportions of each kind of seed.
   2. Seed Inoculant Certification: Bacteria prepared specifically for legume species to be inoculated.
   3. Description of required maintenance activities and activity frequency.

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1.03 DELIVERY, STORAGE, AND PROTECTION

A. Seed:

1. Furnish in standard containers with seed name, lot number, net weight, percentages of purity, germination, and hard seed and maximum weed seed content, clearly marked for each container of seed.
2. Keep dry during storage.

B. Hydroseeding Mulch: Mark package of wood fiber mulch to show air dry weight.

1.04 WEATHER RESTRICTIONS

A. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

1.05 SEQUENCING AND SCHEDULING

A. Complete Work under this section within 10 days following completion of soil preparation.

B. Notify Engineer at least 3 days in advance of:

1. Each material delivery.
2. Start of planting activity.

C. Planting Season: Between March 15 and September 15.

1.06 MAINTENANCE SERVICE

A. Contractor: Perform maintenance operations during maintenance period to include:

1. Watering: Keep surface moist.
2. Washouts: Repair by filling with topsoil, liming, fertilizing, seeding, and mulching.
3. Mulch: Replace wherever and whenever washed or blown away.
4. Mowing: Mow to 2 inches after grass height reaches 3 inches, and mow to maintain grass height from exceeding 3-1/2 inches.
5. Fence: Repair and maintain until satisfactory stand of grass is established.
6. Reseed unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.

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7. Reseed/replant during next planting season if scheduled end of maintenance period falls after September 15.
8. Reseed/replant entire area if satisfactory stand does not develop by July 1 of the following year.

PART 2 PRODUCTS

2.01 FERTILIZER

A. Commercial, uniform in composition, free-flowing, suitable for application with equipment designed for that purpose. Minimum percentage of plant food by weight.

B. Application Rates: Determined by soil analysis results.

C. Mix:

1. Nitrogen: 10.
2. Phosphoric Acid: 10.
3. Potash: 10.

2.02 SEED

A. Fresh, clean new-crop seed that complies with the tolerance for purity and germination established by Official Seed Analysts of North America.

B. Seeds of Legumes: Inoculated with pure culture of nitrogen-fixing bacteria prepared specifically for legume species in accordance with inoculant manufacturer's instructions.

C. Permanent Seed Mix: J.B. Signature Blend by J.B. Sod and Seed (ww.jbinstantlawn.net), (800) 527-1439.

Species	Proportion By Weight
J.B. II Perennial Ryegrass	50
Patriot II Perennial Ryegrass	25
Evening Shade Perennial Ryegrass	25

D. Winter Protective Seed: Annual ryegrass.

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2.03 HYDROSEEDING MULCH

A. Wood Cellulose Fiber Mulch:

1. Specially processed wood fiber containing no growth or germination inhibiting factors.
2. Dyed a suitable color to facilitate inspection of material placement.
3. Manufactured such that after addition and agitation in slurry tanks with water, the material fibers will become uniformly suspended to form homogenous slurry.
4. When hydraulically sprayed on ground, material will allow absorption and percolation of moisture.

2.04 NETTING

A. Matting:

1. Excelsior mat or straw blanket; staples as recommended by matting manufacturer.
2. Manufacturers and Products:
   a. Akzo Industries, Ashville, NC; Curlex mat.
   b. North American Green, Evansville, IN; S150 blanket.

2.05 TACKIFIER

A. Derived from natural organic plant sources containing no growth or germination-inhibiting materials.

1. Capable of hydrating in water, and to readily blend with other slurry materials.
2. Wood Cellulose Fiber: Add as tracer, at rate of 150 pounds per acre.
3. Manufacturers and Products:
   a. Chevron Asphalt Co.; CSS 1.
   b. Terra; Tack AR.
   c. J Tack; Reclamare.

2.06 FENCE

A. 2-inch by 2-inch posts 4 feet high, spaced 10 feet on center, and strung with single strand of No. 12 gauge wire marked with cloth strips at 3-foot intervals.

2.07 EDGING

A. Steel: 3/16 inch by 4 inches wide in 15-foot minimum lengths, manufacturer’s standard black, with 18-inch-long steel stakes and fastenings on curb.

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B. Plastic: Polyethylene edging 1/8 inch by 4 inches wide, black, with integral design to provide a firm hold without staking.

PART 3 EXECUTION

3.01 PREPARATION

A. Grade areas to smooth, even surface with loose, uniformly fine texture.

1. Roll and rake, remove ridges, fill depressions to meet finish grades.
2. Limit such Work to areas to be planted within immediate future.
3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.

B. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.

C. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 FERTILIZER

A. Apply evenly over area in accordance with manufacturer’s instructions. Mix into top 2 inches of topsoil, when applied by broad cast method.

B. Application Rate: 23 pounds per 1,000 square feet (1,000 pounds per acre).

3.03 SEEDING

A. Start within 2 days of preparation completion.

B. Hydroseed slopes steeper than 3H:1V. Flatter slopes may be mechanically seeded.

C. Mechanical: Broadcast seed in two different directions, compact seeded area with cultipacter or roller.

1. Use Brillion type seeder.
2. Broadcasting will be allowed only in areas too small to use Brillion type seeder.
3. Roll with ring roller to cover seed, and water with fine spray.

D. Hydroseeding:

1. Apply on moist soil, only after free surface water has drained away.
2. Prevent drift and displacement of mixture into other areas.

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3. Upon application, allow absorption and percolation of moisture into ground.
4. Mixtures: Seed and fertilizer may be mixed together, apply within 30 minutes of mixing to prevent fertilizer from burning seed.

E. Mulching: Apply uniform cover of wood fiber mulch at rate of 1,500 pounds per acre.

F. Tackifier: Apply over mulched areas with slopes steeper than 4:1 rate of 5 gallons per 1,000 square feet in accordance with the manufacturers recommended requirements.

G. Water: Apply with fine spray after mulching to saturate top 4 inches of soil.

3.04 FIELD QUALITY CONTROL

A. 8 weeks after seeding is complete and on written notice from Contractor, Engineer will, within 15 days of receipt, determine if a satisfactory stand has been established.

B. If a satisfactory stand has not been established, Engineer will make another determination after written notice from Contractor following the next growing season.

3.05 PROTECTION

A. Protect from pedestrian traffic by erecting temporary fence around each newly seeded area.

END OF SECTION

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SECTION 35 20 16.25
FABRICATED SLIDE GATES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Water Works Association (AWWA): C563, Fabricated Composite Slide Gates.
2. ASTM International (ASTM):
   a. A193/A193M, Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
   b. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and General Applications.
   c. A276, Standard Specification for Stainless Steel Bars and Shapes.
   d. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   e. D695, Compressive Properties of Rigid Plastics.
   f. D696, Coefficient of Linear Expansion.
   g. D790, Flexural Properties.
   h. D1056, Polymer Grade.
   i. D2563, Visual Defects.
   j. D2583 Indentation Hardness.
   k. D2584, Resin Glass, and Filler Contents.
3. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).

1.02 DEFINITIONS

A. FRP: Fiberglass reinforced plastic.

B. Self-Contained: The arrangement of gate operator, supported by gate frame, such that operating thrust loads are not applied external to the assembly.

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1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Make, model, and weight of each equipment assembly.
   b. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Detailed Structural and Mechanical Drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment associated therewith.
   d. Gate operator and stem calculations for each gate and service condition.
   e. Gate opening and closing thrust forces that will be transmitted to the support structure with operator at extreme positions and load.
   f. Performance Test Procedures.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
2. Special shipping, storage and protection, and handling instructions.
3. Manufacturer's written/printed installation instructions.
4. Routine maintenance requirements prior to plant startup.
5. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
6. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

1.04 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

Item	Quantity
Stem collars for all gate stems	One of each different size
Bronze lift nuts	One of each different size
Special tools required to maintain or dismantle	One complete set

B. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

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PART 2 PRODUCTS

2.01 GENERAL

A. Provide slide gate discs, compatible with the existing gate frame, sealing strips, stem, and operator.

2.02 SUPPLEMENTS

A. See supplements to this section for additional product information.

2.03 MATERIALS

A. Gate body shall be:

1. Engineered composite fiberglass reinforced plastic (FRP) completely encapsulating an internal steel reinforcing structure.
   a. Molded to create a seamless corrosion barrier impervious to moisture.
   b. FRP resin shall be vinyl ester.
   c. Internal Steel Reinforcing: Carbon Steel as needed for deflection requirements.
   d. Internal Core Foam: 6-pound (0.9 kg) polyisocyanurate closed cell rigid foam.
   e. Coloring: Pigmented gel-coat containing ultra-violet blocking agent; manufacturer's standard color.

B. Gate body shall have UV Stabilizing pigment in the Resin to provide long-term protection from UV.

C. The surface shall be free of exposed reinforcing fibers.

D. The composition of these layers shall be approximately 95 percent (by weight) resin. The remaining laminate shall be made up of copolymer composite and reinforcing fibers in a form, orientation, and position to meet the mechanical requirements.

E. Visual inspection for defects shall be made without the aid of magnification and defects shall be classified as to type and level as shown in Table 1 of ANSI/ASTM D2563-0.

2.04 DESIGN CRITERIA

A. Maximum Fiber Stress: Design with a safety factor of 2 with regard to yield strength.

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B. Head Pressure: Gate shall be designed for head pressure shown on the Gate Schedule.

C. Gate Size: As shown on the Gate Schedule.

D. Surface Conditions:

1. All slide gates shall be flat and level.
2. Warpage throughout the entire gate shall not produce a crown of more than 1/16 inch (1.6 mm) in any direction.
3. Gates having reinforcing members bolted or bonded to flat sheet stock will not be acceptable.

E. Sealed Area: Slide gate shall seal on three sides – no top seal.

2.05 PERFORMANCE REQUIREMENTS

A. Leakage shall not exceed 0.1 gallon per minute per foot of gate periphery under either seating or unseating head conditions.

2.06 SLIDE GATES

A. Rising stem type, with assembly styles designated as follows:

1. Style A: Upward acting type for wall surface mounting on the concrete structures.
2. Style B: Upward acting type for mounting in channels with concrete embedded frame and invert.

B. Disc:

1. Disc Plate (Sliding Member): Engineered composite fiberglass reinforced plastic (FRP) completely encapsulating an internal steel reinforcing structure. Molded to create a seamless corrosion barrier, impervious to moisture.
2. Reinforce as required so that the disc will not deflect more than 1/720 of the gate span, when the upstream liquid depth (seating head side) is as shown on the schedule and the downstream liquid depth is less than 1/2 inch.
3. Dimension compatible with existing sealing strips and clamping bars, to create a watertight seal.
4. Disc shall be compatible with existing 2-inch stem. Connect the stem to the disc plate with a yoke, bolted to the stem and welded to the disc core.

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C. Manufacturers: Manufacturers shall have 10 years' experience in design and manufacture of slide gates and accessories.

1. Ershigs; Plasti-Fab.
2. "Or-equal."

2.07 EXISTING GATE

A. See Detail 301 on Sheet 900-M-4 on the 1986 Tri-City WPCP Record Drawings for existing channel mounted frame and seal details. Detail included as a Supplement at the end of this section.

2.08 APPURTENANCES

A. Lifting Lugs: Furnish suitably attached for equipment assemblies and components weighing over 100 pounds.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with the manufacturer's written instructions.

B. Remove and protect existing gate stem and operator.

C. Protect gate frame.

D. Install disc and set sealing strips per manufacturer's recommendations.

E. Re-install stem and operator after installing gates.

F. Lubricate stems before operating.

3.02 FIELD QUALITY CONTROL

A. Functional Tests: Conduct on each slide gate.

B. Performance Test:

1. Conduct on each slide gate.
2. Perform under actual or approved simulated operating conditions.
3. Test for leakage.
4. Adjust, realign, or modify units and retest if necessary.

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3.03 MANUFACTURER'S SERVICES

A. Manufacturer's Representative:

1. Present at Site or classroom designated by Owner, for minimum person-days listed below, travel time excluded:
   a. 1 person-day for installation assistance and inspection.
   b. 1/2 person-day for functional and performance testing and completion of Manufacturer's Certificate of Proper Installation.
   c. 1/2 person-day for maintenance training of Owner's personnel.

B. See Section 01 43 33, Manufacturers' Field Services. and Section 01 91 14, Equipment Testing and Facility Startup.

C. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, for installation assistance, inspection and certification of proper installation, equipment testing, startup assistance, and training of Owner's personnel for specified component, subsystem, equipment, or system.

3.04 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification.

1. Slide Gate Schedule.
2. Detail 301/900-M-4 (1986 Tri-City WPCP Record Drawings).

END OF SECTION

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SLIDE GATE SCHEDULE						
Gate Identification No. and Location	**Assembly Style**	**Wall Opening (width/height inches)**	**Gate Height (inches)**	**Flow Stream**	**Design Operating Head (feet) Seating/Unseating Condition**	**Operator Type/ Control Style**
210-G-2161 Primary Sedimentation Basins	B	84/93	93	PI	7.5/0	Existing Manual Rising Stem
210-G-2162 Primary Sedimentation Basins	B	84/93	93	PI	7.5/0	Existing Manual Rising Stem

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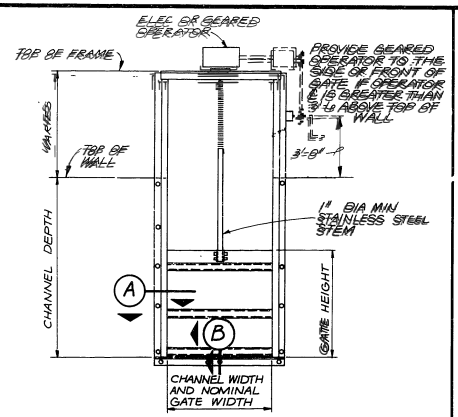
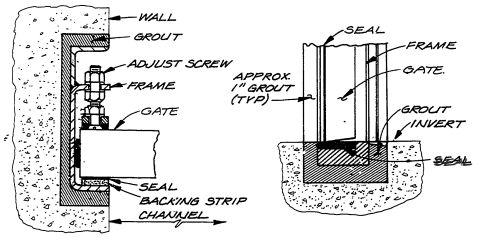
DETAIL 301/900-M-4
(1986 TRI-CITY WPCP RECORD DRAWINGS)



STYLE A

SECTION A SECTION B

FOR WALL MOUNTED GATES



SECTION A SECTION B

FOR CHANNEL MOUNTED GATES

SLUICE GATE 301

RECORD DRAWINGS

Date NOV 1986

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION FURNISHED BY OTHERS, THAT ARE NOT A PART OF OUR CONTRACT. THE EXACT LOCATION, SIZE, AND OTHER CHARACTERISTICS OF ANY WORK DONE THE CONTRACTOR, WHICH INCORPORATED INTO THE

ELEVATION

SECTION A

SECTION B

GATE DETAIL 305

SLIDE GATE

GATE GUIDE - TYPE GG-1

NOTES FOR FABRICATED ALUMINUM GATES:
1. GUIDES TO BE ASSEMBLED AS A COMPLETE UNIT. CROSS BRACE PRIOR TO SHIPPING TO MAINTAIN CORRECT ALIGNMENT.
2. GUIDES TO BE CONTINUOUS WELDED TO GATE RESTS.
3. ANCHORS FOR GATE RESTS SIMILAR TO GATE GUIDES.
4. WELD STIFFENERS TO GATE AS REQUIRED TO LIMIT MAX. DEFLECTION UNDER MAX HEAD TO WIDTH/270.
5. SEE DRAWINGS FOR ADDITIONAL GATE REQUIREMENTS.

HAND SLIDE DETAIL 306

CH2M HILL

DESIGN: G.A. NICHOLSON
DR: L. Stockslager
CHK: [signature]
APVD: [signature]

NO.	DATE	REVISION	BY	APVD
	11/7/86	RECORD DRAWING	JML	JBL

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

MECHANICAL STANDARD DETAILS

SHEET 300-M-4
NO. 49 OF 493
DATE MAY 1985
JOB P-15600.A1

NOTE: IF THIS RECORDED DRAWING IS LESS CLEAR THAN THE ORIGINAL, IT BECOMES THE OWNER'S COPY OF THE ORIGINAL DRAWING

24X

SECTION 40 05 15
PIPING SUPPORT SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. American Society of Mechanical Engineers (ASME): B31.1, Power Piping.
3. ASTM International (ASTM):
   a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
   c. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
4. International Code Council (ICC):
   a. International Building Code (IBC).
   b. International Mechanical Code (IMC).
5. Manufacturers' Standardization Society (MSS):
   a. SP 58, Pipe Hangers and Supports—Materials, Design and Manufacture.
   b. SP 127, Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, and Application.

1.02 DEFINITIONS

A. Wetted or Submerged: Submerged, less than 1 foot above liquid surface, below top of channel wall, under cover or slab of channel or tank, or in other damp locations.

1.03 SUBMITTALS

A. Action Submittals:

1. Catalog information and drawings of piping support system, locating each support, sway brace, seismic brace, hanger, guide, component, and anchor for piping 6 inches and larger. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.

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2. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.

B. Informational Submittals: Maintenance information on piping support system.

1.04 DESIGN REQUIREMENTS

A. General:

1. All Piping: Support systems have been designed for piping shown.

B. Pipe Support Systems:

1. Maximum Support Spacing and Minimum Rod Size: In accordance MSS SP 58 Table 3 and Table 4.
   a. HDPE 10 Inches and Under: Maximum span limited to 8 feet.
   b. Ductile-iron Pipe 10 Inches and Under: Maximum span limited to that for standard weight steel pipe for water service.

C. Anchoring Devices: As shown.

D. Existing Support Systems: Use existing supports systems to support new piping only if Contractor can show they are adequate for additional load, or if they are strengthened to support additional load.

PART 2 PRODUCTS

2.01 GENERAL

A. When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated.

B. Special support and hanger details may be required for cases where standard catalog supports are not applicable.

C. Materials: In accordance with Table 1 attached as Supplements at end of section.

2.02 HANGERS

A. Clevis: MSS SP 58, Type 1.

1. Anvil; Figure 260 for steel pipe and Figure 590 for ductile-iron pipe, sizes 1/2 inch through 30 inches.

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2. Insulated Steel Pipe: Anvil; Figure 260 with insulated saddle system (ISS), sizes 1/2 inch through 16 inches.
3. B-Line; Figure B3100, sizes 1/2 inch through 30 inches.

2.03 WALL BRACKETS, SUPPORTS, AND GUIDES

A. Welded Steel Wall Bracket: MSS SP 58, Type 33 (heavy-duty).

1. Anvil; Figure 199, 3,000-pound rating.
2. B-Line; Figure B3067, 3,000-pound rating.

B. Adjustable “J” hanger MSS SP 58, Type 5:

1. Anvil; Figure 67, sizes 1/2 inch through 8 inches.
2. B-Line; Figure B3690, sizes 1/2 inch through 8 inches.

C. Offset Pipe Clamp: Anvil; Figure 103, sizes 3/4 inch through 8 inches.

D. Channel Type:

1. Unistrut.
2. Anvil; Power-Strut.
3. B-Line; Strut System.

2.04 CHANNEL TYPE SUPPORT SYSTEMS

A. Channel Size: 12-gauge, 1-5/8-inch wide minimum steel, or 1-1/2-inch wide, minimum FRP.

B. Members and Connections: Design for loads using one-half of manufacturer’s allowable loads.

C. Fasteners: Vinyl ester fiber, polyurethane base composite nuts and bolts, or encapsulated steel fasteners.

D. Manufacturers and Products:

1. B-Line; Strut System.
2. Unistrut.
3. Anvil; Power-Strut.

2.05 PIPE ANCHORS

A. Type: Anchor chair with U-bolt strap.

B. Manufacturer and Product: B-Line; Figure B3147A or Figure B3147B.

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2.06 ACCESSORIES

A. Anchor Bolts:

1. Size and Material: Sized by Contractor for required loads, 1/2-inch minimum diameter, and as specified in Section 05 05 19, Post-Installed Anchors.
2. Bolt Length (Extension Above Top of Nut):
    a. Minimum Length: Flush with top of nut preferred. If not flush, shall be no more than one thread recessed below top of nut.
    b. Maximum Length: No more than a full nut depth above top of nut.

B. Dielectric Barriers:

1. Plastic coated hangers, isolation cushion, or tape.
2. Manufacturer and Products:
    a. B-Line; B1999 Vibra Cushion.
    b. B-Line; Iso Pipe, Isolation Tape.

C. Insulation Shields:

1. Type: Stainless steel, MSS SP 58, Type 40.
2. Manufacturers and Products:
    a. Anvil; Figure 167, sizes 1/2 inch through 24 inches.
    b. B-Line; Figure B3151, sizes 1/2 inch through 24 inches.

D. Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP 58.

E. Attachments:

1. I-Beam Clamp: Concentric loading type, MSS SP 58, Type 21, Type 28, Type 29, or Type 30, which engage both sides of flange.
2. Concrete Insert: MSS SP 58, Type 18, continuous channel insert with load rating not less than that of hanger rod it supports.
3. Welded Beam Attachment: MSS SP 58, Type 22.
    a. Anvil; Figure 66.
    b. B-Line; Figure B3083.
4. Concrete Attachment Plates:
    a. Anvil; Figure 47, Figure 49, or Figure 52.
    b. B-Line; Figure B3084, Figure B3085, or Figure B3086.

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PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install support systems in accordance with MSS SP 58, unless shown otherwise.
2. Install pipe hanger rods plumb, within 4 degrees of vertical during shut down, start up or operations.
3. Support piping connections to equipment by pipe support and not by equipment.
4. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
5. Support no pipe from pipe above it.
6. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
7. Do not use adhesive anchors for attachment of supports to ceiling or walls.
8. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
9. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.
10. Install lateral supports for seismic loads at changes in direction.
11. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
12. Repair mounting surfaces to original condition after attachments are completed.

B. Standard Pipe Supports:

1. Horizontal Suspended Piping:
   a. Single Pipes: Clevis hangers or adjustable swivel split-ring.
   b. Grouped Pipes: Trapeze hanger system.
2. Horizontal Piping Supported from Walls:
   a. Single Pipes: Wall brackets, or attached to wall, or to wall mounted framing with anchors.
   b. Stacked Piping: Wall mounted framing system and “J” hangers acceptable for pipe smaller than 3-inch.
   c. Pipe clamp that resists axial movement of pipe through support is not acceptable. Use pipe rollers supported from wall bracket.

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3. Horizontal Piping Supported from Floors:
    a. Saddle Supports:
        1) Pedestal Type, elbow, and flange.
        2) Provide minimum 1-1/2-inch grout beneath baseplate.
    b. Floor Mounted Channel Supports:
        1) Use for pipe smaller than 3-inch running along floors and in trenches at pipe elevations lower than can be accommodated using pedestal pipe supports.
        2) Attach channel framing to floors with baseplate on minimum 1-1/2-inch nonshrink grout and with anchor bolts.
        3) Attach pipe to channel with clips or pipe clamps.
    c. Concrete Cradles: Use for pipe larger than 3 inches along floor and in trenches at pipe elevations lower than can be accommodated using stanchion type.
4. Insulated Pipe:
    a. Pipe hanger and support shall be on outside of insulation. Do not enclose within insulation.
    b. Provide precut 120-degree sections of rigid insulation (minimum length same as shield), shields and oversized hangers or insulated saddle system (ISS).
    c. Wall-mounted pipe clips not acceptable for insulated piping.
5. Vertical Pipe: Support with wall bracket and elbow support, or riser clamp on floor penetration.

C. Standard Attachments:

1. Existing Concrete Ceilings:
    a. Channel type support with minimum of two anchor points, concrete attachment plates or concrete anchors as limited below:
        1) Single point attachment to ceiling is allowed only for 3/4-inch rod and smaller (8 inches and smaller pipe).
2. Concrete Walls: Concrete inserts or brackets or clip angles with concrete anchors.
3. Concrete Beams: Concrete inserts, or if inserts are not used attach to vertical surface similar to concrete wall. Do not drill into beam bottom.

D. Saddles for Steel or Concrete Pipe: Provide 90-degree to120-degree pipe saddle for pipe sizes 6 inches and larger when installed on top of steel or concrete beam or structure, pipe rack, trapeze, or where similar concentrated point supports would be encountered.

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E. Intermediate and Pipe Alignment Guides:

1. Provide pipe alignment guides, or pipe supports that provide same function, at expansion joints and loops.
2. Guide pipe on each side of expansion joint or loop at 4 pipe and 14 pipe diameters from each joint or loop.
3. Install intermediate guides on metal framing support systems not carrying pipe anchor or alignment guide.

F. Accessories:

1. Insulation Shield: Install on insulated piping with oversize rollers and supports.
2. Welding Insulation Saddle: Install on insulated steel pipe with oversize rollers and supports.
3. Dielectric Barrier:
   a. Provide between painted or galvanized carbon steel members and copper or stainless steel pipe or between stainless steel supports and nonstainless steel ferrous metal piping.
   b. Install rubber wrap between submerged metal pipe and oversized clamps.

3.02 SUPPLEMENT

A. The supplement listed below, following “End of Section,” is a part of this Specification:

1. Table 1: Material Selection.

END OF SECTION

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Table 1
Material Selection

Exposure Conditions	Support Material
Submerged, Indoors, Outdoors	Type 316 SST

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SECTION 40 27 00
PROCESS PIPING—GENERAL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section and any supplemental Data Sheets:

1. Air Force: A-A-58092, Tape, Antiseize, Polytetrafluorethylene.
2. American Society of Mechanical Engineers (ASME):
   a. B1.20.1, Pipe Threads, General Purpose (Inch).
   b. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
   c. B16.3, Malleable Iron Threaded Fittings Classes 150 and 300.
   d. B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
   e. B16.9, Factory-Made Wrought Buttwelding Fittings.
   f. B16.11, Forged Fittings, Socket-Welding and Threaded.
   g. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
   h. B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   i. B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings Classes 150, 300, 600, 900, 1500, and 2500.
   j. B16.25, Buttwelding Ends.
   k. B16.42, Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
   l. B31.1, Power Piping.
   m. B31.3, Process Piping.
   n. B31.9, Building Services Piping.
   o. B36.10M, Welded and Seamless Wrought Steel Pipe.
3. American Water Works Association (AWWA):
   a. C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
   b. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
   c. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
   d. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   e. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
   f. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast.

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g. C153/A21.53, Ductile-Iron Compact Fittings.
h. C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
i. C606, Grooved and Shouldered Joints.

4. ASTM International (ASTM):
   a. A276, Standard Specification for Stainless Steel Bars and Shapes.
   b. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
   c. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   d. A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
   e. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
   f. A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
   g. A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
   h. A536, Standard Specification for Ductile Iron Castings.
   i. A774/A774M, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
   j. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
   k. B75/B75M, Standard Specification for Seamless Copper Tube.
   l. B88, Standard Specification for Seamless Copper Water Tube.
   m. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
   n. B462, Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08024, UNS N08026, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, and UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service.
   o. B464, Standard Specification for Welded UNS N08020 Alloy Pipe.
   p. D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
   q. D413, Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate.
   r. D1330, Standard Specification for Rubber Sheet Gaskets.

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s. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
t. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
u. D2464, Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
v. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
w. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
x. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
y. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
z. D2996, Standard Specification for Filament-Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
aa. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
bb. D4101, Standard Specification for Polypropylene Injection and Extrusion Materials.
cc. D4894, Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials.
dd. D4895, Standard Specification for Polytetrafluoroethylene (PTFE) Resin Produced from Dispersion.
ee. F423, Standard Specification for Polytetrafluoroethylene (PTFE) Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.
ff. F436, Standard Specification for Hardened Steel Washers.
gg. F437, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
hh. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
ii. F441/F441M, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
jj. F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
kk. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ll. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

5. FM Global (FM).

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6. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP-43, Wrought and Fabricated Butt-Welding Fittings for Low-Pressure, Corrosion Resistant Applications.
7. National Electrical Manufacturers Association (NEMA): LI 1, Industrial Laminating Thermosetting Products.
8. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.02 DEFINITIONS

A. Submerged or Wetted:

1. Zone Below Elevation Of:
   a. Liquid surface or within 3 feet above top of liquid surface.
   b. Top of tank wall or under tank cover.

1.03 DESIGN REQUIREMENTS

A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

1. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.
2. Building Service Piping: ASME B31.9, as applicable.
   a. Local plumbing code.
3. Thrust Restraints: Design for test pressure shown in Piping Schedule.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Fabricated Piping:
   a. Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, and other pertinent information.
   b. Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.
2. Pipe Wall Thickness: Identify wall thickness and rational method or standard applied to determine wall thickness for each size of each different service including exposed, submerged, buried, and concrete-encased installations for Contractor-designed piping.
3. Hydraulic Thrust Restraint for Restrained Joints: Details including materials, sizes, assembly ratings, and pipe attachment methods.

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4. Thrust Blocks: Concrete quantity, bearing area on pipe, and fitting joint locations.
5. Dissimilar Buried Pipe Joints: Joint types and assembly drawings.
6. Pipe Corrosion Protection: Product data.

B. Informational Submittals:

1. Manufacturer's Certification of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
   a. Pipe and fittings.
   b. Factory applied resins and coatings.
2. Flanged Pipe and Fittings: Manufacturer's product data sheets for gaskets including torqueing requirements and bolt tightening procedures.
3. Test logs.
4. Pipe coating applicator certification.
5. Laboratory Testing Equipment: Certified calibrations, manufacturer's product data, and test procedures.
6. Component and attachment testing seismic certificate of compliance as required by Section 01 45 33, Special Inspection, Observation, and Testing.

1.05 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 61 00, Common Product Requirements:

1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.
2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 PIPING

A. As specified on Piping Data Sheet(s) located at the end of this section as Supplement and on Drawings.

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B. Diameters Shown:

1. Standardized Products: Nominal size.
2. Fabricated Steel Piping (Except Cement-Lined): Outside diameter, ASME B36.10M.
3. Cement-Lined Steel Pipe: Lining inside diameter.

2.02 JOINTS

A. Grooved End System:

1. Rigid type.
2. Use of flexible grooved joints allowed where shown on Drawings or with prior approval by Engineer.
3. Flanges: When required, furnish with grooved type flange adapters of same manufacturer as grooved end couplings.

B. Flanged Joints:

1. Flat-faced, carbon steel, or alloy flanges when mating with flat-faced cast or ductile iron flanges.
2. Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.

C. Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1.

D. Mechanical Joint Anchor Gland Follower:

1. Ductile iron anchor type, wedge action, with break-off tightening bolts.
2. Thrust rated to 250 psi minimum.
3. Rated operating deflection not less than:
   a. 3 degrees for sizes through 12 inches.
   b. 2 degrees for sizes 14 inches through 16 inches.
   c. 1.5 degrees for sizes 18 inches through 24 inches.
   d. 1 degree for sizes 30 inches through 48 inches.
4. UL and FM approved.

E. Flexible Mechanical Compression Joint Coupling:

1. Stainless steel, ASTM A276, Type 305 bands.
2. Manufacturers:
   a. Pipeline Products Corp.
   b. Fernco Joint Sealer Co.

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F. Mechanical connections of high-density polyethylene pipe to auxiliary equipment such as valves, pumps, tanks, and other piping systems shall be through-flanged connections consisting of the following:

1. Polyethylene stub end thermally butt-fused to end of pipe.
2. ASTM A240/A240M, Type 304 stainless steel backing flange, 125-pound, ASME B16.1 standard. Use insulating flanges where shown.
3. Bolts and nuts of sufficient length to show a minimum of three complete threads when joint is made and tightened to manufacturer's standard. Retorque nuts after 4 hours.
4. Gaskets as specified on Data Sheet.

2.03 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or "or-equal" will be allowed.

2.04 PIPE CORROSION PROTECTION

A. Coatings: See Section 09 90 00, Painting and Coating, for details of coating requirements.

B. Insulating Flanges, Couplings, and Unions:

1. Materials:
   a. In accordance with applicable piping material specified in Pipe Data Sheet. Complete assembly shall have ASME B31.3 working pressure rating equal to or higher than that of joint and pipeline.
   b. Galvanically compatible with piping.
   c. Resistant for intended exposure, operating temperatures, and products in pipeline.
2. Union Type, 2 Inches and Smaller:
   a. Screwed or solder-joint.
   b. O-ring sealed with molded and bonded insulation to body.
3. Flange Type, 2-1/2 Inches and Larger:
   a. Flanged, complete with bolt insulators, dielectric gasket, bolts, and nuts.
   b. Bolt insulating sleeves shall be provided full length between insulating washers.
   c. Ensure fit-up of components of insulated flange assembly to provide a complete functioning installation.
   d. AWWA C207 steel flanges may be drilled oversize up to 1/8-inch to accommodate insulating sleeves.

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e. No less than minimum thread engagement in accordance with specified bolting standards will be permitted to accommodate thicknesses of required washers, flanges, and gasket.

4. Flange Insulating Kits:
   a. Gaskets: Full-face, Type E with elastomeric sealing element. Sealing element shall be retained in a groove within retainer portion of gasket.
   b. Insulating Sleeves: Full-length fiberglass reinforced epoxy (NEMA LI-1, G-10 grade).
   c. Insulating Washers: Fiberglass-reinforced epoxy (NEMA LI-1, G-10 grade).
   d. Steel Washers: Hardened steel, ASTM F436, 1/8 inch thick.
      1) Flange Diameters 36 Inches or Less: Provide two washers per bolt.
      2) Flange Diameters Larger Than 36 Inches: Provide four washers per bolt.
5. Manufacturers and Products:
   a. Dielectric Flanges and Unions:
      1) GPT, Houston, TX.
      2) Lamons, Houston, TX.
   b. Insulating Couplings:
      1) Dresser; STAB-39.
      2) Baker Coupling Company, Inc.; Series 216.

2.05 VENT AND DRAIN VALVES

A. Pipeline 2-Inch Diameter and Smaller: 1/2-inch vent, 1-inch drain, unless shown otherwise.

B. Pipelines 2-1/2-Inch Diameter and Larger: 3/4-inch vent, 1-inch drain, unless shown otherwise.

2.06 FABRICATION

A. Mark each pipe length on outside with the following:

1. Size or diameter and class.
2. Manufacturer’s identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

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C. Shop fabricate flanged pipe in shop, not in field, and delivered to Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by manufacturer.

2.07 FINISHES

A. Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s), Piping Schedule, and Section 09 90 00, Painting and Coating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

B. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

3.02 PREPARATION

A. See Piping Schedule and Section 09 90 00, Painting and Coating, for additional requirements.

B. Notify Engineer at least 2 weeks prior to field fabrication of pipe or fittings.

C. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

D. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer’s instructions, except for damaged glass-lined pipe that is to be promptly removed from Site.

3.03 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer’s instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Flanged Joints:

1. Install perpendicular to pipe centerline.
2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.

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3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast-iron flange.
7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
8. Flange fillers are to be avoided, but if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.
10. Manufacturer: Same as pipe manufacturer or grooved joint flange adapter manufacturer.

D. Threaded and Coupled Joints:

1. Conform to ASME B1.20.1.
2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
3. Countersink pipe ends, ream and clean chips and burrs after threading.
4. Make connections with not more than three threads exposed.
5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

E. Grooved-End Joints:

1. Piping shall be grooved in accordance with manufacturer’s latest published instructions and shall be accurately cut with tools conforming to coupling manufacturer’s standards and to AWWA C606.
2. Install grooved joint couplings and gaskets in accordance with manufacturer’s latest published installation instructions.

F. PVC and CPVC Piping:

1. Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
2. Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
3. Do not thread Schedule 40 pipe.

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G. Ductile Iron Piping:

1. Cutting Pipe: Cut pipe with milling type cutter, rolling pipe cutter, or abrasive blade cutter. Do not flame cut.
2. Dressing Cut Ends:
   a. General: As required for the type of joint to be made.
   b. Rubber Gasketed Joints: Remove sharp edges or projections.
   c. Push-On Joints: Bevel, as recommended by pipe manufacturer.
   d. Flexible Couplings, Flanged Coupling Adapters, and Grooved End Pipe Couplings: As recommended by the coupling or adapter manufacturer.

H. High-Density Polyethylene Piping:

1. Join pipes, fittings, and flange connections by means of thermal butt-fusion.
2. Perform butt-fusion in accordance with pipe manufacturer's recommendations as to equipment and technique.
3. Special Precautions at Flanges: Polyethylene pipe connected to heavy fittings, manholes, and rigid structures shall be supported in such a manner that no subsequent relative movement between polyethylene pipe at flanged joint and rigid structures is possible.

3.04 INSTALLATION—EXPOSED PIPING

A. Piping Runs:

1. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
2. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

B. Supports: As specified in Section 40 05 15, Piping Support Systems.

C. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

D. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

E. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

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F. Piping clearance, unless otherwise shown:

1. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
2. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
3. From Adjacent Work: Minimum 1 inch from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
4. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
5. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
6. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
7. Do not route piping over, around, in front of, in back of, or below electrical equipment, including controls, panels, switches, terminals, boxes, or other similar electrical work.

3.05 PIPE CORROSION PROTECTION

A. Ductile Iron Pipe:

1. Exposed: System No. 4 as specified in Section 09 90 00, Painting and Coating, and as shown in Piping Schedule.
2. Submerged or Embedded: System No. 2 as specified in Section 09 90 00, Painting and Coating, and as shown in Piping Schedule.

B. PVC and CPVC Pipe, Exposed: System No. 25 as specified in Section 09 90 00, Painting and Coating.

C. Piping Accessories:

1. Exposed, Submerged:
   a. Field paint iron, steel, black steel, galvanized steel, stainless steel, aluminum, brass, copper, and bronze piping components as specified in Section 09 90 00, Painting and Coating, as applicable to base metal material.
      1) Submerged: System No. 2.
      2) Exposed: System No. 4.

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b. Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.

D. Insulating Flanges, Couplings, and Unions:

1. Applications:
   a. Dissimilar metal piping connections.
   b. Submerged to unsubmerged metallic piping connections.
   c. Connections to existing metallic pipe.
   d. Where required for electrically insulated connection.
2. Pipe Installation:
   a. Insulating joints connecting immersed piping to nonimmersed piping shall be installed above maximum water surface elevation.
   b. Submerged carbon steel, ductile iron, or galvanized piping in reinforced concrete shall be isolated from the concrete reinforcement steel.
   c. Align and install insulating joints as shown on Drawings and according to manufacturer's recommendations. Bolt lubricants that contain graphite or other metallic or electrically conductive components that can interfere with the insulating capabilities of the completed flange shall not be used.

3.06 THRUST RESTRAINT

A. Location:

1. Buried Piping: Where shown and where required to restrain force developed at pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist because of hydrostatic testing and normal operating pressure.
2. Exposed Piping: At all joints in piping.

B. Mechanical Joint Valve Restraint in Proprietary Restrained Joint Piping: Install pipe joint manufacturer's adapter gland follower and pipe end retainer, or mechanical joint anchor gland follower.

3.07 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Application and Installation: As specified in Section 40 27 01, Process Piping Specialties.

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3.08 BRANCH CONNECTIONS

A. Do not install branch connections smaller than 1/2-inch nominal pipe size, including instrument connections, unless shown otherwise.

B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including first block valve in the line carrying the lower pressure, unless otherwise shown.

C. Threaded Pipe Tap Connections:

1. Ductile Iron Piping: Connect only with service saddle or at tapping boss of a fitting, valve body, or equipment casting.
2. Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.
3. Limitations: Threaded taps in pipe barrel are unacceptable.

3.09 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines as shown.

3.10 FIELD FINISHING

A. Notify Engineer at least 3 days prior to start of surface preparation or coating application work.

B. As specified in Section 09 90 00, Painting and Coating.

3.11 PIPE IDENTIFICATION

A. Pipe Labels:

1. Snap-on, reversible type with lettering and directional arrows, sized for outside diameter of pipe and insulation.
2. Provided with ties or straps for pipes of 6 inches and over in diameter.
3. Designed to firmly grip pipe so labels remain fixed in vertical pipe runs.
4. Material: Heavy-duty vinyl or polyester, suitable for exterior use, long lasting, and resistance to moisture, grease, and oils.
5. Letters and Arrows: Black on OSHA safety yellow background.
6. Color Field and Letter Height: Meet ASME A13.1.
7. Message: Piping system name as indicated on Piping Schedule.

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8. Manufacturers and Products:
    a. Brady Signmark; B-915 BradySnap-On and Strap-On Pipe Markers.
    b. Seton Identification Products; Ultra-mark Pipe Markers.

B. Pipe Labels:

1. Labels: Self-adhesive tape, with separate directional flow arrow banding tape.
2. Material: Pressure sensitive vinyl.
3. Letters and Arrows: Black on OSHA safety yellow background.
4. Color Field and Letter Height: ASME A13.1.
5. Message: Piping system name as indicated on Piping Schedule.
6. Manufacturers and Products:
    a. Brady Signmark; B-946 Self-Sticking Vinyl Pipe Markers and Directional Flow Arrow Tape.
    b. Seton Identification Products; Opti-Code Markers and Arrows-On-A-Roll Tape.

3.12 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: As specified in Section 40 80 01, Process Piping Leakage Testing.

3.13 CLEANING

A. Following assembly and testing, and prior to final acceptance, flush pipelines, except as stated below, with water at 2.5 fps minimum flushing velocity until foreign matter is removed.

B. Blow clean of loose debris plant process air and instrument air lines with compressed air at 4,000 fpm; do not flush with water.

C. If impractical to flush large diameter pipe at 2.5 fps or blow at 4,000 fpm velocity, clean in-place from inside by brushing and sweeping, then flush or blow line at lower velocity.

D. Insert cone strainers in flushing connections to attached equipment and leave in-place until cleaning is complete.

E. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

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3.14 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Piping Schedule.
2. Data Sheets.

Number	Title
40 27 00.01	Cement-Mortar-Lined Ductile Iron Pipe and Fittings
40 27 00.10	Polyvinyl Chloride (PVC) Pipe and Fittings

END OF SECTION

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PIPING SCHEDULE LEGEND

SERVICE

A	Air
AHP	Air-High Pressure
ALP	Air-Low Pressure
D	Drain
RD	Roof Drain
PS	Primary Sludge
PSM	Primary Scum
SD	Storm Drain
SS	Sanitary Sewer
V	Vents
W1	Water-Potable
W2	Water-Non-potable (City source)
W3	Water-Non-potable (Service- CAS/MBR effluent)
W4	Water-Non-potable (High pressure – CAS effluent)
W5	Water-Non-potable (Flushing – CAS effluent)

EXPOSURE

ALL	All
BUR	Buried
EXP	Exposed
SUB	Submerged
ENC	Concrete Encased

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MATERIAL

CLDI	Cement-Lined Ductile Iron
COP	Copper
DI	Ductile Iron
GLDI	Glass-Lined Ductile Iron
GSP	Galvanized Steel Pipe
PVC	Polyvinyl Chloride
SST	Stainless Steel
STL	Steel

JOINT TYPE

FL	Flanged
GR	Grooved
HU	Hub and spigot
PRJ	Proprietary Restrained
RM	Restrained Mechanical
S	Screwed
W	Welded (including solvent and fusion)

PRESSURE TEST

G	Gravity Service: Test pressure is not shown on gravity services. Test to highest liquid level that pipe can be subject to.
H	Hydrostatic
I	In Service

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P	Pneumatic
PC	Test per Uniform Plumbing Code
NA	Not Applicable

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PIPING SCHEDULE

Service	Legend	Size(s) (In.)	Exposure	Piping Material, Note 4	Specification Section	Joint Type, Note 5	Lining/ Coating, Note 2	Test Pressure and Type (psig-x), Note 6	Pipe Color and Label, Note 1, 3	Remarks
Drain	D	2”	SUB	PVC	40 27 00.10	W, S	None/None	G	NA	
Roof Drain	RD	4"	EXP, SUB	PVC-DWV	22 10 01.02	W, NH	None/System No.25	G	Gull Gray	Test in accordance with plumbing code. Insulate roof drains per Section 22 10 01, Plumbing Piping and Accessories.
Non-potable (Flushing – effluent)	W5	10"	SUB	HDPE	22 10 01.08	W, FL	None/None	150 - H	Safety Green	Pressure test prior to drilling holes in the pipe. CLDI material, unless shown otherwise.
				CLDI	40 27 00.01	FL	Cement/System No. 2			

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PIPING SCHEDULE

Service	Legend	Size(s) (In.)	Exposure	Piping Material, Note 4	Specification Section	Joint Type, Note 5	Lining/ Coating, Note 2	Test Pressure and Type (psig-x), Note 6	Pipe Color and Label, Note 1, 3	Remarks

Note 1: Match existing colors onsite.

Note 2: Coating system number as specified in Section 09 90 00, Painting and Coating, and as specified in Article Pipe Corrosion Protection.

Note 3: Label exposed piping.

Note 4: Piping as specified in applicable piping specifications:

CLDI: Concrete lined ductile iron
HDPE: High density polyethylene
PVC: Polyvinyl chloride
PVC-DWV: Polyvinyl chloride – drain, waste, vent

Note 5: Joints shall be as specified in the applicable piping specification.

FL: Flanged
NH: No hub
W: Welded, fused, socket welded, glued, or solvent welded

Note 6: Pressure testes as specified in Section 40 80 01, Process Piping Leakage Testing.
G: Gravity
H: Hydrostatic

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SECTION 40 27 00.01 CEMENT-MORTAR -LINED DUCTILE IRON PIPE AND FITTINGS	
Item	**Description**
General	Materials in contact with potable water shall conform to NSF 61 acceptance. Pipe manufacturer shall submit certification that source manufacturing facility has been producing ductile iron pipe of specified diameters, dimensions, and standards for a period of not less than 10 years. Testing of pipe required by AWWA C151/A21.51 shall be conducted in testing and laboratory facilities located in the USA and operating under USA laws and regulations. Pipe shall be handled during manufacture and shipped without nesting (without insertion of one pipe inside another).
Pipe	Buried Liquid Service Using Mechanical or Proprietary Restrained Joints: AWWA C111/A21.11, and AWWA C151/A21.51, pressure class conforming to Table 5 and Table 7 for Type 4 trench, 250 psi minimum working pressure. Follower glands shall be ductile iron. Buried Air Service Using Mechanical or Proprietary Restrained Joints: AWWA C151/A21.51, pressure class conforming to Table 5 and Table 7 for Type 4 trench, 250 psi minimum working pressure. Follower glands shall be ductile iron. Exposed Pipe Using Grooved End and Flange Joints: AWWA C115/A21.15, thickness Class 53 minimum, 250 psi minimum working pressure.
Lining	Cement-mortar: AWWA C104/A21.4. Glass: ASTM B1000.
Fittings	Lined and coated same as pipe. Mechanical: AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C153/A21.53 ductile iron, 250 psi minimum working pressure. Follower glands shall be ductile iron. Proprietary Restrained: AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C153/A21.53, ductile iron, 250 psi minimum working pressure. Restraint shall be achieved with removable metal elements fitted between a welded bar on the pipe barrel and the inside of the joint bell or fitting sizes smaller than 16 inches may be mechanical joint, restrained by anchor gland followers, ductile iron anchor type, wedge action, with break-off tightening bolts. Assembled joints shall be rated

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SECTION 40 27 00.01
CEMENT-MORTAR -LINED DUCTILE IRON PIPE AND FITTINGS

Item	Description
	for deflection in operation at rated pressure. Rated deflection shall be not less than 1-1/2 degrees for 36-inch and smaller pipe. Rated deflection shall be not less than 1/2 degree for 42-inch and larger pipe. Clow Corp., American Cast Iron Pipe Co., U.S. Pipe. Restrained joints relying on metal teeth molded into the gasket to prevent joint separation under pressure will not be accepted. Grooved End: AWWA C606 and AWWA C110/A21.10, ductile iron, 250 psi minimum working pressure; Victaulic. Flange: AWWA C110/A21.10 ductile iron, faced and drilled, Class 125 flat face. Gray cast iron will not be allowed.
Joints	Mechanical: 250 psi minimum working pressure. Proprietary Restrained: 150 psi minimum working pressure. Clow Corp., Super-Lock; American Cast Iron Pipe Co., Flex-Ring or Lok-Ring; U.S. Pipe, TR Flex. Grooved End: Rigid type radius cut conforming to AWWA C606, 250 psi minimum working pressure; Victaulic. Flange: Dimensions per AWWA C110/A21.10 flat face ductile iron, threaded conforming to AWWA C115/A21.15. Gray cast iron will not be allowed. Branch connections 3 inches and smaller, except from glass-lined pipe, shall be made with service saddles as specified in Section 40 27 01, Process Piping Specialties. Branch connections, 3 inches and smaller from glass-lined pipe shall be made with glass-lined tee with a flanged branch for adapting to branch piping.
Couplings	Grooved End: 250 psi minimum working pressure, malleable iron per ASTM A47/A47M or ductile iron per ASTM A536; Victaulic. Grooved End Adapter Flanges: 250 psi minimum working pressure, malleable iron per ASTM A47/A47M or ductile iron per ASTM A536; Victaulic.

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SECTION 40 27 00.01
CEMENT-MORTAR -LINED DUCTILE IRON PIPE AND FITTINGS

Item	Description
Bolting	Mechanical, Proprietary Restrained, and Grooved End Joints: Manufacturer's standard. Flanged: ASTM A307, Grade B carbon steel heavy hex head or stud bolts, ASTM A563, Grade A carbon steel heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations. Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M heavy hex head or stud bolts; ASTM A194/A194M, Grade 8M heavy hex nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations.
Gaskets	General: Gaskets in contact with potable water shall be NSF ANSI 61 certified. Mechanical and Proprietary Restrained Joints; Water and Sewage Service: Halogenated butyl or EPDM, Shore A hardness durometer 60, conforming to AWWA C111/A21.11. Mechanical and Proprietary Restrained Joints; Hot Air Service: EPDM or Viton, Shore A hardness durometer 60, conforming to AWWA C111/A21.11. Grooved End Joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606. Flanged, Water, Sewage Services: 1/8-inch-thick, homogeneous black rubber (EPDM), hardness 60-80 (Shore A), rated to 275 degrees F, conforming to ASME B16.21 and ASTM D2000. Full face for flat-faced flanges, flat-ring type for raised-face flanges. Blind flanges shall be epoxy-lined in accordance with the system specified above. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.
Joint Lubricant	Manufacturer's standard.

END OF SECTION

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SECTION 40 27 00.10 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS		
Item	**Size**	**Description**
General	All	Materials in contact with potable water shall conform to NSF 61 acceptance.
Pipe	All	Schedule 80 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection. Threaded Nipples: Schedule 80 PVC.
Fittings	All	Schedule to Match Pipe Above: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.
Joints	All	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	All	One-piece, molded hub type PVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling.
Bolting	All	Flat Face Mating Flange and In Corrosive Areas: ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Torque bolts per gasket manufacturer's recommendation. With Raised Face Mating Flange: Carbon steel ASTM A307 Grade B square head bolts, ASTM A563 Grade A heavy hex head nuts and ASTM F436 hardened steel washers at nuts and bolt heads. Torque bolts per gasket manufacturer's recommendation.

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SECTION 40 27 00.10
POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

Item	Size	Description
Gaskets	All	Flat Face Mating Flange: Full faced 1/8-inch-thick ethylene propylene (EPR) rubber. Raised Face Mating Flange: Flat ring 1/8-inch ethylene propylene (EPR) rubber, with filler gasket between OD of raised face and flange OD to protect the flange from bolting moment.
Solvent Cement	All	Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.
Thread Lubricant	All	Teflon Tape.

END OF SECTION

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SECTION 40 27 01
PROCESS PIPING SPECIALTIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
   b. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
2. American Water Works Association (AWWA):
   a. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
   b. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
   c. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
   d. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   e. C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
   f. Manual M11, Steel Pipe—A Guide for Design and Installation.
3. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A276, Standard Specification for Stainless Steel Bars and Shapes.
4. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
5. NSF International (NSF):
   a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
   b. NSF/ANSI 372, Drinking Water System Components - Lead Content.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer’s data on materials, construction, end connections, ratings, overall lengths, and live lengths (as applicable).
2. Metal Bellows Field Finishing:
   a. Manufacturer’s recommended weld procedures for joining welded carbon steel piping to stainless steel bellows.

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b. Welder qualifications for joining welded carbon steel piping to stainless steel bellows.
c. Product data for field-applied System No. 4, high temperature, epoxy lining and coating in accordance with Section 09 90 00, Painting and Coating.

3. Chemical Injectors:
a. Type, size, quantity, materials, and model number of each.
b. Sketch of each showing major parts, main pipe, and dimensions.
c. Details and model number of each support system and component.
d. Details and model of connects (for example, service saddle, weld-o-let).

B. Informational Submittals:

1. Coupling Harness:
a. Details, ratings, calculations and test reports for thrust restraints relying on welded bars or rings.
b. Weld procedure qualifications.
c. Load proof-testing report of prototype restraint for any size coupling.

2. Basket Strainer:
a. Manufacturer's written/printed installation instructions.
b. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

C. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide required piping specialty items, whether shown or not shown on Drawings, as required by applicable codes and standard industry practice.

B. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded, screwed, and flanged pipe joints are not considered flexible.

2.02 COUPLINGS

A. General:

1. Couplings shall be rated for working pressure not less than indicated in Piping Schedule for the service and not less than 150 psi.

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2. Couplings shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C213.
3. Unless thrust restraint is provided by other means, couplings shall be harnessed in accordance with requirements of AWWA Manual M11 or as shown on Drawings.
4. Sleeve type couplings shall conform to AWWA C219 and shall be hydraulically expanded beyond minimum yield for accurate sizing and proofing of tensile strength.

B. Restrained Flange Adapter:

1. Pressure Rating:
   a. Minimum Working Pressure Rating: Not less than 150 psi.
   b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer's proof testing.
2. Thrust Restraint:
   a. Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
   b. Products employing set screws that bear directly on pipe will not be acceptable.
3. Manufacturer and Product: EBAA Iron Sales Co.; Mega-Flange.

C. Exposed Metallic Piping Plain End Couplings:

1. Plain end pipe couplings shall be self-restrained against hydrostatic thrust forces equal to not less than two times the working pressure rating of the coupling. Couplings shall accommodate 4 degrees angular deflection at the time of installation and subsequent to pressurization.
2. Casing, bolts, and nuts shall be Type 304 or Type 316 stainless steel. The sealing sleeve shall be EPDM or NBR elastomer as best suited for the fluid service.
3. Couplings manufacturer and products shall be Straub Couplings, Grip-L or Metal Grip, "or-equal."

2.03 OUTLET/TAPPING SADDLES

A. Materials:

1. Straps: Alloy steel with 3/4-inch threaded ends.
2. Seal: O-Ring SBR rubber gasket.
3. Compatible with ductile iron pipe.

B. Connection: As shown.

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C. Pressure Rating: Capable of withstanding 250 psi internal pressure without leakage over stressing.

D. Manufacturer and Product: American Ductile Iron; Outlet/Tapping Saddle.

2.04 PIPE SLEEVES

A. Molded Polyethylene Pipe Sleeve:

1. Molded HDPE with integral water stop ring not less than 3 inches larger than sleeve.
2. Provided with end caps for support during concrete placement.
3. Manufacturer and Product: Century-Line, Model CS sleeves as manufactured by PSI-Thunderline/Link-Seal.

B. Modular Mechanical Seal:

1. Type: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.
2. Fabrication:
   a. Assemble interconnected rubber links with ASTM A276, Type 316 stainless steel bolts and nuts.
   b. Pressure plates shall be reinforced nylon polymer.
3. Size: According to manufacturer's instructions for size of pipes shown to provide a watertight seal between pipe and wall sleeve opening, and to withstand a hydrostatic head of 40 feet of water.
4. Manufacturer: Thunderline Corp., Link-Seal Division.

2.05 SLAB, FLOOR, WALL AND ROOF PENETRATIONS

A. Ductile Iron Wall Pipe:

1. Diameter, Lining, and Ends: Same as connecting ductile iron pipe.
2. Thickness: Equal to or greater than remainder of pipe in line.
3. Fittings: In accordance with applicable Pipe Data Sheet.
4. Thrust Collars:
   a. Rated for thrust load developed at 250 psi.
   b. Safety Factor: 2, minimum.
   c. Material and Construction: Ductile iron or cast iron, cast integral with wall pipe wherever possible, or thrust rated, welded attachment to wall pipe.
5. Manufacturers:
   a. American Cast Iron Pipe Co.
   b. U.S. Pipe and Foundry Co.

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2.06 MISCELLANEOUS SPECIALTIES

A. Water Hose:

1. Furnish 50-foot lengths of 1-inch and 50-foot lengths of 1-1/2-inch rubber hose. EPDM black cover and EPDM tube, reinforced with two textile braids. Provide each length with brass male and female NST hose thread couplings to fit hose nozzle and hose valve.
2. Rated minimum working pressure of 200 psi.
3. Manufacturers:
   a. Goodyear.
   b. Boston.

B. Hose Nozzles:

1. Furnish 1-inch and 1-1/2-inch cast brass, satin finish, nozzles with adjustable fog, straight-stream, and shut-off feature and rubber bumper. Provide nozzles with female NST hose thread.
2. Manufacturers:
   a. Croker.
   b. Elkhart.

2.07 FACTORY FINISHING

A. Factory prepare, prime, and finish coat in accordance with Section 09 90 00, Painting and Coating.

1. Submerged: System No. 2.
2. Exposed: System No. 4.

PART 3 EXECUTION

3.01 GENERAL

A. Provide accessibility to piping specialties for control and maintenance.

3.02 PIPING FLEXIBILITY PROVISIONS

A. General:

1. Thrust restraint shall be provided as specified in Section 40 27 00, Process Piping—General.
2. Install flexible couplings to facilitate piping installation, in accordance with approved Shop Drawings.

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3.03 PIPING TRANSITION

A. Applications:

1. Provide complete closure assembly where pipes meet other pipes or structures.
2. Pressure Pipeline Closures: Plain end pieces with double flexible couplings, unless otherwise shown.
3. Restrained Joint Pipe Closures: Install with thrust tie-rod assemblies as shown.
4. Gravity Pipe Closures: As specified for pressure pipelines, or concrete closures.

B. Installation:

1. Flexible Transition Couplings: Install in accordance with coupling manufacturer’s instructions to connect dissimilar pipe and pipes with a small difference in outside diameter.
2. Concrete Closures:
   a. Locate away from structures so there are at least two flexible joints between closure and pipe entering structure.
   b. Clean pipe surface before placing closure collars.
   c. Wet nonmetallic pipe thoroughly prior to pouring collars.
   d. Prevent concrete from entering pipe.
   e. Extend collar a minimum of 12 inches on each side of joint with minimum thickness of 6 inches around outside diameter of pipe.
   f. Make entire collar in one placement.
   g. After concrete has reached initial set, cure by covering with well-moistened earth.

3.04 PIPING EXPANSION

A. Piping Installation: Allow for thermal expansion due to differences between installation and operating temperatures.

B. Anchors and Anchor Walls: Install as specified in Section 40 05 15, Piping Support Systems, to withstand expansion joint thrust loads and to direct and control thermal expansion.

3.05 SERVICE SADDLES

A. Ferrous Metal Piping (except stainless steel): Double-strap iron.

B. Plastic Piping: Nylon-coated iron.

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3.06 OUTLET/TAPPING SADDLE

A. Install in accordance with manufacturer's written instructions.

3.07 COUPLINGS

A. General:

1. Install in accordance with manufacturer's written instructions.
2. Before coupling, clean pipe holdback area of oil, scale, rust, and dirt.
3. Remove pipe coating if necessary to present smooth surface.
4. Application:
   a. Metallic Piping Systems: Flexible couplings, transition couplings, and flanged coupling adapters.
   b. Concrete Encased Couplings: Flexible coupling.

3.08 SLAB, FLOOR, WALL AND ROOF PENETRATIONS

A. Applications:

1. Existing Walls: Rotary drilled holes.

B. Wall Pipe Installation:

1. Isolate embedded metallic piping from concrete reinforcement using coated pipe penetrations as specified in Section 09 90 00, Painting and Coating.
2. Support wall pipes securely by formwork to prevent contact with reinforcing steel and tie-wires.

3.09 FIELD FINISHING

A. Field finish in accordance with Section 09 90 00, Painting and Coating.

1. Submerged: System No. 2.
2. Exposed: System No. 4.

END OF SECTION

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SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Gas Association (AGA): 3, Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids.
2. American National Standards Institute (ANSI): Z21.15, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
3. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   b. B16.44, Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi.
4. American Society of Sanitary Engineers (ASSE): 1011, Performance Requirements for Hose Connection Vacuum Breakers.
5. American Water Works Association (AWWA):
   a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C500, Metal-Seated Gate Valves for Water Supply Service.
   c. C504, Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
   d. C508, Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
   e. C509, Resilient-Seated Gate Valves for Water Supply Service.
   f. C510, Double Check Valve Backflow Prevention Assembly.
   g. C511, Reduced-Pressure Principle Backflow Prevention Assembly.
   h. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   i. C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
   j. C541, Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
   k. C542, Electric Motor Actuators for Valves and Slide Gates.
   l. C550, Protective Interior Coatings for Valves and Hydrants.
   m. C606, Grooved and Shouldered Joints.
   n. C800, Underground Service Line Valves and Fittings.

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6. ASTM International (ASTM):
   a. A276, Standard Specification for Stainless Steel Bars and Shapes.
   b. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
   c. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   d. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
   e. B61, Standard Specification for Steam or Valve Bronze Castings.
   f. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
   g. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
   h. B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
   i. B139/B139, Standard Specification for Phosphor Bronze Rod, Bar and Shapes.
   j. B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
   k. B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.
   l. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
   m. D429, Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
   n. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
7. International Association of Plumbing and Mechanical Officials (IAPMO).
8. Manufacturers Standardization Society (MSS):
   a. SP-80, Bronze Gate, Globe, Angle, and Check Valves.
   b. SP-81, Stainless Steel, Bonnetless, Flanged Knife Gate Valves.
   c. SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.
   d. SP-88, Diaphragm Valves.
   e. SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
9. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

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10. NSF International (NSF):
    a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
    b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
11. UL.
12. USC Foundation for Cross-Connection Control and Hydraulic Research.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
    b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
    c. For each power actuator provided, manufacturer's standard data sheet, with application specific features and options clearly identified.
    d. Sizing calculations for open-close/throttle and modulating valves.

B. Informational Submittals:

1. Tests and inspection data.
2. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.
3. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, operating nut, chain, wrench, and accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe, unless otherwise called out on Drawings or in Supplements.

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D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in stated valve standard.

F. Size operators and actuators to operate valve for full range of pressures and velocities.

G. Valve to open by turning counterclockwise, unless otherwise specified.

H. Factory mount operator, actuator, and accessories.

2.02 MATERIALS

A. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

1. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139/B139M (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
2. Stainless steel Alloy 18-8 may be substituted for bronze.

B. Valve materials in contact with or intended for drinking water service to meet the following requirements:

1. Materials to comply with requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements.
2. Coatings materials to be formulated from materials deemed acceptable to NSF/ANSI 61.

2.03 FACTORY FINISHING

A. General:

1. Interior coatings for valves and hydrants shall be in accordance with AWWA C550, unless otherwise specified.
2. Exterior coating for valves and hydrants shall be in accordance with Section 09 90 00, Painting and Coating.
3. Material in contact with potable water shall conform to NSF/ANSI 61.
4. Exposed safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be “safety yellow.”

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B. Where epoxy lining and coating are specified, factory finishing shall be as follows:

1. In accordance with AWWA C550.
2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2.04 VALVES

A. Globe Valves:

1. Type V237 Angle Pattern Hose Valve 1 Inch to 2 Inches:
   a. All-bronze, NPT threaded ends, inside screw-type rising stem, TFE disc, cast brass male NPT by male NHT adapter with hexagonal center wrench nut, brass cap with chain, complies with MSS SP-80, rated 300 WOG.
   b. Manufacturers and Products:
      1) Stockham; Figure B-222T.
      2) Crane Co.; Cat. No. 17TF.
      3) Nibco; Figure T-335-Y.

B. Ball Valves:

1. Type V306 Stainless Steel Ball Valve 2 Inches and Smaller:
   a. Two-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end piece, NPT threaded ends, ASTM A276 Type 316 stainless steel ball, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 1,000 psig CWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Conbraco Apollo; 76F-100 Series.
      2) Nibco; T-585-S6-R-66-LL.
2. Type V330 PVC Ball Valve 2 Inches and Smaller:
   a. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon O-ring stem seals, to block flow in both directions.

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b. Manufacturers and Products:
   1) Nibco; Chemtrol Tru-Bloc.
   2) ASAHI/America; Type 21.
   3) Spears; True Union.

2.05 OPERATORS AND ACTUATORS

A. Manual Operators:

1. General:
   a. For AWWA valves, operator force not to exceed requirements of applicable valve standard. Provide gear reduction operator when force exceeds requirements.
   b. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
   c. Operator self-locking type or equipped with self-locking device.
   d. Position indicator on quarter-turn valves.
   e. Worm and gear operators one-piece design, worm-gears of gear bronze material. Worm of hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rod with internally threaded bronze or ductile iron nut.
2. Exposed Operator:
   a. Galvanized and painted handwheel.
   b. Cranks on gear type operator.
   c. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
   d. Valve handles to take a padlock, and wheels a chain and padlock.

2.06 ACCESSORIES

A. T-Handled Operating Wrench:

1. One each galvanized operating wrenches, 4 feet long.
2. Manufacturers and Products:
   a. Mueller; No. A-24610.
   b. Clow No.; F-2520.
3. One each galvanized operating keys for cross handled valves.

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B. Extension Bonnet for Valve Operator: Complete with enclosed stem, extension, support brackets, and accessories for valve and operator.

1. Manufacturers:
   a. Pratt.
   b. DeZurik.

C. Floor Stand:

1. Nonrising, heavy pattern, indicating type.
2. Complete with solid extension stem, coupling, handwheel, stem guide brackets, and yoke attachment. Stem length as required to connect valve operating nut and floor stand.
3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
4. Anchor Bolts: Type 304 stainless steel.
5. Manufacturers and Products:
   a. Clow; Figure F-5515.
   b. Mueller, Figure A-26426.

D. Floor Box:

1. Plain type, for support of nonrising type stem.
2. Complete with solid extension stem, operating nut, and stem guide brackets. Stem length as required to extend valve operating nut to within 3 inches of finish floor.
3. Stem Guide: Space such that stem L/R ratio does not exceed 200.
4. Anchor Bolts: Type 304 stainless steel.
5. Manufacturers and Products:
   a. Neenah Foundry; R 7506.
   b. Clow; No. F5690.

PART 3 EXECUTION

3.01 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

B. Screwed Ends:

1. Clean threads by wire brushing or swabbing.
2. Apply joint compound.

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C. PVC and CPVC Valves: Install using solvents approved for valve service conditions.

D. Valve Installation and Orientation:

1. General:
   a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
   b. Install valves in location for easy access for routine operation and maintenance.
   c. Install valves per manufacturer's recommendations.
2. Gate, Globe, and Ball Valves:
   a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
   b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.
3. Check Valves:
   a. Install valve in accordance with manufacturer's instructions and provide required distance from immediate upstream fitting.
   b. Install valve in vertical flow (up) piping only for gas services.
   c. Install swing check valve with shaft in horizontal position.
   d. Install double disc swing check valve to be perpendicular to flow pattern when discs are open.
4. Solenoid Valves: Install in accordance with manufacturer's instructions.

E. Install line size ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters, for isolation during maintenance.

F. Locate valve to provide accessibility for control and maintenance. Install access doors in finished walls and plaster ceilings for valve access.

G. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

H. Torque Tube: Where operator for quarter-turn valve is located on floor stand, furnish extension stem torque tube of a type properly sized for maximum torque capacity of valve.

I. Floor Box and Stem: Steel extension stem length shall locate operating nut in floor box.

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3.02 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

D. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.

E. Set, verify, and record set pressures for relief and regulating valves.

F. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.

G. Test hydrostatic relief valve seating; record leakage. Adjust and retest to maximum leakage of 0.1 gpm per foot of seat periphery.

3.03 FIELD FINISHING

A. Field finish in accordance with Section 09 90 00, Painting and Coating.

1. Submerged: System No. 2.
2. Exposed: System No. 4.

3.04 MANUFACTURER'S SERVICES

A. See Section 01 43 33, Manufacturers' Field Services, and Section 01 91 14, Equipment Testing and Facility Startup.

END OF SECTION

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SECTION 40 80 01
PROCESS PIPING LEAKAGE TESTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Testing Plan:
   a. Submit prior to testing and include at least the information that follows:
      1) Testing dates.
      2) Piping systems and section(s) to be tested.
      3) Test type.
      4) Method of isolation.
      5) Calculation of maximum allowable leakage for piping section(s) to be tested.
2. Certifications of Calibration: Testing equipment.
3. Certified Test Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Engineer in writing 5 days in advance of testing. Perform testing in presence of Engineer.

B. Pressure Piping:

1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
2. Wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 2 days.
3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
4. New Piping Connected to Existing Piping:
   a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.

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b. Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by Engineer.

5. Test Pressure: As indicated on Piping Schedule.

C. Test section may be filled with water and allowed to stand under low pressure prior to testing.

D. Gravity Piping:

1. Perform testing after service connections, manholes, and backfilling have been completed between stations to be tested.
2. Determine groundwater level at time of testing by exploratory holes or other method acceptable to Engineer.
3. Pipe 42 Inches Diameter and Larger: Joint testing device may be used to isolate and test individual joints.

3.02 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.

B. Exposed Piping:

1. Perform testing on installed piping prior to application of insulation.
2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
4. Maintain hydrostatic test pressure continuously for 30 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
5. Examine joints and connections for leakage.
6. Correct visible leakage and retest as specified.

3.03 HYDROSTATIC TEST FOR GRAVITY PIPING

A. Testing Equipment Accuracy: Plus or minus 1/2-gallon water leakage under specified conditions.

B. Maximum Allowable Leakage: 0.16 gallon(s) per hour per inch diameter per 100 feet. Include service connection footage in test section, subjected to minimum head specified.

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C. Gravity Sanitary and Roof Drain Piping: Test with 15 feet of water to include highest horizontal vent in filled piping. Where vertical drain and vent systems exceed 15 feet in height, test systems in 15-foot vertical sections as piping is installed.

D. Defective Piping Sections: Replace or test and seal individual joints, and retest as specified.

3.04 FIELD QUALITY CONTROL

A. Test Report Documentation:

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:
   a. Leaks (type, location).
   b. Repair/replacement performed to remedy excessive leakage.
6. Signed by Contractor and Engineer or Owner Representative to represent that test has been satisfactorily completed.

END OF SECTION

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SECTION 40 90 00
INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section gives general requirements for Process Instrumentation and Control (PIC). The following PIC subsections expand on requirements of this section:

1. Section 40 91 00, Instrumentation and Control Components.

B. Major Work Items: Include, but are not limited to, engineering, furnishing, installing, calibrating, configuring, adjusting, testing, documenting, starting up, and training for a complete PIC system.

1. Process instrumentation including primary elements, transmitters, control devices, and control panels.
   a. Local alarm control panel, 210-LCP-2100, designed and provided by the PIC System Integrator.
   b. Combustible gas analyzer.
   c. Horns and beacons.
2. Work in existing control panels. Wiring of new I/O points.
   a. Project includes six sludge cross collectors and six primary sludge collectors, for a total of twelve units, each with four I/O points. The I/O used for the existing six units shall be identified and reused. The remaining I/O shall be wired to spare I/O in CP-1. Provide field investigation to identify and locate spare terminal blocks and power connections for all devices, as identified in PLC I/O List. Determine if there are adequate existing spare terminal blocks in the panel. If not, provide new location and terminal blocks internal to the panel.
   b. Six new scum skimmers to reuse existing motor starters and PLC I/O.
   c. Supply Fans 1 and 2 running signals to 420-CP-010 discrete inputs. Fans running output to new alarm panel, 210-LCP-2100. A combustible gas analyzer high limit signal will be input to the alarm panel to be combined with the fans running signals to then output a common alarm to 420-CP-010 discrete input. Provide field investigation to identify and locate spare terminal blocks for the three discrete inputs and one discrete output.

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3. Support for Applications Software:
    a. Application software will be provided by Portland Engineering, Inc., the Owner's Application Software Integrator of Record, for both PLC and HMI equipment. Work related to supporting this activity provided by the Contractor includes:
        1) Assistance with onsite checkout of applications software.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section and other PIC subsections:

1. American National Standards Institute (ANSI).
2. ASTM International (ASTM):
    a. A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
    b. A276, Standard Specification for Stainless Steel Bars and Shapes.
    c. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
    d. B32, Standard Specification for Solder Metal.
    e. B88, Standard Specification for Seamless Copper Water Tube.
3. Deutsche Industrie-Norm (DIN): VDE 0611, Specification for modular terminal blocks for connection of copper conductors up to 1,000V ac and up to 1,200V dc.
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE): C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
5. International Society of Automation (ISA):
    a. RP12.06.01, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation Part 1: Intrinsic Safety.
    b. S5.1, Instrumentation Symbols and Identification.
    c. S5.4, Instrument Loop Diagrams.
    d. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
    e. TR20.00.01, Specification Forms for Process Measurement and Control Instruments, Part 1: General.
6. International Conference on Energy Conversion and Application (ICECA).
7. National Electrical Code (NEC).

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8. National Electrical Manufacturers Association (NEMA):
    a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
    b. ICS 1, Industrial Control and Systems General Requirements.
9. National Fire Protection Association (NFPA): 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
10. NSF International (NSF):
    a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
    b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
11. UL: 508A, Standard for Safety, Industrial Control Panels.

1.03 DEFINITIONS

A. Abbreviations:

1. HMI: Human-Machine Interface.
2. HVAC: Heating, Ventilating, and Air Conditioning.
3. I&C: Instrumentation and Control.
4. I/O: Input and Output.
5. O&M: Operation and Maintenance.
6. P&ID: Process and Instrument Diagram.
7. PIC: Process Instrumentation and Control.
8. PLC: Programmable Logic Controller.
9. SCADA: Supervisory Control and Data Acquisition.

B. Application Software: Software to provide PLC and HMI functions unique to this Project.

C. Definitions:

1. Owner’s Application Software Integrator of Record: Entity responsible for the Application Software integration.
2. PIC System Integrator: Entity responsible for items defined in Section 40 90 00, Instrumentation and Control for Process Systems, and Section 40 91 00, Instrumentation and Control Components.

D. Signal Types:

1. Analog Signal, Current Type:
    a. 4 mA to 20 mA dc signals conforming to ISA S50.1.
    b. Unless otherwise indicated for specific PIC subsection components, use the following ISA S50.1 options:
        1) Transmitter Type: Number 2, two-wire.

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2) Transmitter Load Resistance Capacity: Class L.
3) Fully isolated transmitters and receivers.

2. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.

1.04 SYSTEM DESCRIPTION

A. PIC design as shown and specified includes:

1. P&IDs.
2. Control Panel.
3. Instrument List.
4. PLC I/O List.

B. Design Requirements: Complete detailed design of PIC components and PIC drawings, including control panels, control panel layouts, panel wiring diagrams and interconnecting wiring diagrams.

C. Use a qualified PIC System Integrator for at least the following work:

1. For PIC Equipment and Ancillaries:
   a. Completing detail design.
   b. Submittals.
   c. Equipment, enclosures, and ancillaries.
   d. Instructions, details, and recommendations to, and coordination with Contractor for Certificate of Proper Installation.
   e. Verify readiness for operation.
   f. Verify correctness of final power and signal connections (lugging and connecting).
   g. Adjusting and calibrating.
   h. Starting up.
   i. Testing and coordination of testing.
   j. Training.
   k. Assist District’s Application Software Integrator of Record with Functional Test Part 2 as defined in Article Field Quality Control.
2. Verify following Work not by PIC System Integrator is provided:
   a. Correct type, size, and number of signal wires with their raceways.
   b. Correct electrical power circuits and raceways.
3. Non-PIC Equipment Directly Connected to PIC Equipment:
   a. Obtain from Contractor, manufacturers’ information on installation, interface, function, and adjustment.
   b. Coordinate with Contractor to allow required interface and operation with PIC.

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c. For operation and control, verify installations, interfacing signal terminations, and adjustments have been completed in accordance with manufacturer's recommendations.
d. Test to demonstrate required interface and operation with PIC.
e. Examples of items in this category, but not limited to the following:
1) Motor control centers.
2) Section 44 42 24.02, Rectangular Primary Clarifier Mechanism.

D. General:

1. Submittal Format:
a. Hard Copy: Required for all submittals.
b. Electronic Copies: Required, unless otherwise noted for specific items.
1) Manufacturers' Standard Documents: Adobe Acrobat PDF.
2) Documents created specifically for Project:
a) Text and Graphics: Microsoft Word.
b) Lists: Microsoft Excel, unless otherwise noted for specific items.
c) Drawings: AutoCAD.
2. Identify proposed items, options, installed spares, and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).
3. Legends and Abbreviation Lists: Definition of symbols and abbreviations used.
4. Activity Completion:
a. Action Submittals: Completed when reviewed and approved.
b. Informational Submittals: Completed when reviewed and found to meet conditions of the Contract.

E. Action Submittals:

1. Identification of existing spare terminal blocks and wiring, or spare panel space for terminations and wiring in existing control panel.
2. Bill of Materials: List of required equipment.
a. Group equipment items by enclosure and field, and within an enclosure, as follows:
1) PIC Components: By component identification code.
2) Other Equipment: By equipment type.
b. Data Included:
1) Equipment tag number.
2) Description.

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3) Manufacturer, complete model number and all options not defined by model number.
4) Quantity supplied.
5) Component identification code where applicable.
6) For panels, include panel reference number and name plate inscription.

c. Formats: Hard copy and Microsoft Excel.

3. Catalog Cuts:
   a. I&C Components, Electrical Devices, and Mechanical Devices:
      1) Catalog information, marked to identify proposed items and options.
      2) Descriptive literature.
      3) External power and signal connections.
      4) Scaled drawings showing exterior dimensions and locations of electrical and mechanical interfaces.
4. Instrument List:
   a. Refer to Supplement Instrument List at the end of this section. Data from this may be used as a starting point for creating final Instrument List and Component Data Sheets.
   b. Complete Instrument List by adding manufacturer and complete model number for each instrument and device.
   c. Submit updated version of Instrument List.
5. I/O List:
   a. Refer to Supplement I/O List at the end of this section. Data from this may be used as a starting point for creating final I/O.
   b. Complete I/O List by adding Rack/Slot/Point assignments.
      1) Eighteen DIs and six DOs shall be identified and reused from the previous sludge collector I/O. Six spare DOs have been identified on the existing cards to be used. Add any additional I/O where required. Use Owner furnished spare Siemens 505-4216ADI card.
      2) Three DIs and one DO shall be identified in 420-CP-010.
   c. Submit updated version of I/O List.
6. Component Data Sheets: Data sheets for I&C components.
   a. Content:
      1) Similar to ISA TR20.00.01.
      2) Specific features and configuration data for each component, including but not limited to:
         a) Tag Number.
         b) Component type identification code and description.
         c) Location or service.
         d) Service conditions.
         e) Manufacturer and complete model number.
         f) Size and scale range.

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g) Setpoints.
h) Materials of construction.
i) Options included.
j) Power requirements.
k) Signal interfaces.
l) Name, address, and telephone number of manufacturer's local office, representative, distributor, or service facility.

b. Electronic Copies: Microsoft Excel.

7. Panel Elevation and Construction Drawings:
   a. Scale Drawings: Show dimensions and location of front of panel devices.
   b. Panel Legend (Bill of Material): List front of panel devices by tag number. Include nameplate inscriptions, service legends, and annunciator inscriptions.
   c. Submit electronic copies of Drawings.
   d. Scale Drawings: Show dimensions and locations of panel-mounted devices, doors, louvers, subpanels, internal and external.
   e. Panel Legend (Bill of Material): List front of panel devices by tag numbers, nameplate inscriptions, and service legends.
   f. Bill of Materials: List devices mounted within panel that are not listed in panel legend. Include tag number, description, manufacturer, and model number.
   g. Construction Details: NEMA rating, materials, material thickness, structural stiffeners and brackets, lifting lugs, mounting brackets and tabs, door hinges and latches, and welding and other connection callouts and details.
   h. Construction Notes: Finishes, wire color schemes, wire ratings, wire, terminal block numbering, and labeling scheme.
   i. Submit electronic copies of Drawings.
8. Detailed Panel Wiring Diagrams:
   a. Panel Wiring Diagrams for discrete control and power circuits.
      1) Refer to alarm panel wiring for functional requirements on Drawings.
   b. Cover wiring within a panel including, but not limited to, instrumentation, control, power, and communications, and digital networks.
   c. Item Identification: Identify each item with attributes listed.
      1) Wires: Wire number and color. Cable number if part of multiconductor cable.
      2) Terminals: Location (enclosure number, terminal junction box number, or MCC number), terminal strip number, and terminal block number.

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3) Components:
   a) Tag number, terminal numbers, and location ("FIELD", enclosure number, or MCC number).
   b) Switching action (open or close on rising or falling process variable), setpoint value and units, and process variable description (for example, Sump Level High).
4) I/O Points: PLC unit number, I/O tag number, I/O address, terminal numbers, and terminal strip numbers.

d. Show each circuit individually. No "typical" diagrams or "typical" wire lists will be allowed.
e. Ground wires, surge protectors, and connections.
f. Wire and Cable Names: Show names and wire color for circuits entering and leaving a panel. Refer to Division 26, Electrical.
g. Prepare as-built redline markup of detailed wiring diagrams.
h. Submit electronic copies of Drawings.

F. Informational Submittals:

1. Operation and Maintenance Data:
   a. In accordance with Section 01 78 23, Operation and Maintenance Data, and in addition the following:
      1) General:
         a) Provide sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for PIC components.
         b) Submittal Format: Per Section 01 33 00, Submittal Procedures.
      2) Provide the following items as defined under heading Action Submittals:
         a) Bill of materials.
         b) Catalog cuts.
         c) Instrument list.
         d) Component data sheets.
         e) Detailed Wiring Diagrams: As-built drawings.
            (1) Panel wiring diagrams.
      3) Manufacturer's O&M manuals for components, electrical devices, and mechanical devices:
         a) Content for Each O&M Manual:
            (1) Table of Contents.
            (2) Operations procedures.
            (3) Installation requirements and procedures.
            (4) Maintenance requirements and procedures.
            (5) Troubleshooting procedures.

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(6) Calibration procedures.
(7) Internal schematic and wiring diagrams.
(8) Component and I/O Module Calibration Sheets from field quality control calibrations.

b) Provide PDF file with linked index to all manuals.

b. Testing Related Submittals:
1) Functional Tests:
a) Test Procedures: Proposed test procedures, forms, and checklists.
b) Test Documentation:
(1) Copy of signed-off test results.
(2) Completed component calibration sheets.
2) Performance Test:
a) Test Procedures: Proposed test procedures, forms, and checklists.
b) Test Documentation: Copy of signed-off test results.

1.05 QUALITY ASSURANCE

A. PIC Coordination Meetings:

1. As needed throughout the project for coordination items.
2. Discuss Engineer's comments, testing requirements, and resolve any PIC coordination issues.

1.06 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 61 00, Common Product Requirements.

B. Prior to shipment, include corrosive inhibitive vapor capsules in shipping containers, and related equipment as recommended by capsule manufacturer.

C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.

D. Cover panels and other elements that are exposed to dusty construction environments.

1.07 SEQUENCING AND SCHEDULING

A. Refer to Section 01 31 13, Project Coordination, for Contractor's scheduling requirements for applications software testing.

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B. Prerequisite Activities and Lead Times:

1. Do not start following key Project activities until prerequisite activities and lead times listed below have been completed and satisfied:
   a. Shop Drawing Reviews by Engineer:
      1) Schedule: In accordance with Section 01 33 00, Submittal Procedures.
   b. Test Prerequisite: Associated test procedures Submittals completed.
   c. Training Prerequisite: Coordination with Contractor, Engineer, and Owner.
   d. Panel Shipment to Site:
      1) General Prerequisites: Approval of PIC Shop Drawings and preliminary operation and maintenance data.
   e. Functional Test Part 1 Prerequisite: Instrumentation, control panels, MCC and package system installation complete.
   f. Functional Test Part 2 Prerequisite: Functional Test Part 1 completed.
   g. Performance Test Prerequisite: Functional Test Part 2 completed and facility started up.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide PIC functions shown on Drawings and required in PIC subsections for each system. Furnish equipment items required in PIC subsections. Furnish materials and equipment, except for Integrator of Record provided applications software, whether indicated or not, necessary to effect required system performance.

B. First Named Manufacturer: PIC design is based on first named manufacturers of equipment, materials, and software.

1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with the General Conditions, Article 6.05 Substitutes, and “or-equal”.
2. If proposed item requires, but not limited to, different installation, wiring, raceway, enclosures, intrinsically safe barriers, and accessories, provide such equipment and work.

C. Like Equipment Items: Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer’s services.

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2.02 I&C COMPONENTS

A. Specifications: Refer to Section 40 91 00, Instrumentation and Control Components, for specifications for I&C components.

B. Components: Major components are listed in Instrument List referenced in Article Supplements. Furnish equipment that is necessary to achieve required performance.

C. Alarm Control Panel: 210-LCP-2100.

2.03 SERVICE CONDITIONS

A. Service Condition for Panel 210-LCP-2100:

1. Design panel and equipment for continuous operation in this environment:
   a. Panels and Assemblies: NEMA 4X, stainless steel.

2.04 NAMEPLATES AND TAGS

A. Panel Nameplates: Enclosure identification located on enclosure face.

1. Location and Inscription: Panel description and tag number.
2. Materials: Laminated plastic attached to panel with stainless steel screws.
3. Letters: 1/2-inch-high, white on black background, unless otherwise noted.

B. Component Nameplates, Panel Face: Component identification located on panel face under or near component.

1. Location and Inscription: As shown on panel drawing.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch-high, white on black background, unless otherwise noted.

C. Component Nameplates, Back of Panel: Component identification located on or near component inside of enclosure.

1. Inscription: Component tag number.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch-high, white on black background, unless otherwise noted.

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D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches:

1. Inscription: Refer to P&IDs on Drawings.
2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.
3. Letters: Black on gray or white background.

E. Service Legends: Component identification nameplate located on face of component.

1. Inscription: As shown on panel submittal.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch-high, white on black background, unless otherwise noted.

F. Nametags: Component identification for field devices.

1. Inscription: Component tag number.
2. Materials: 16-gauge, Type 304 stainless steel.
3. Letters: 3/16-inch-high, imposed.
4. Mounting: Affix to component with 16-gauge or 18-gauge stainless steel wire or stainless steel screws.

2.05 ELECTRICAL REQUIREMENTS

A. Wires within Enclosures:

1. ac Circuits:
   a. Type: 600-volt, Type MTW stranded copper.
   b. Size: For current to be carried, but not less than No. 18 AWG.
2. Analog Signal Circuits:
   a. Type: 600-volt stranded copper, twisted shielded pairs or triad with a 100 percent, aluminum-polyester shield, rated 60 degrees C.
   b. Panels with Circuits Less Than 600 Volts: Rated at 600 volts. Belden No. 18 AWG Type 9341, Triad Beldon No. 1121A.
   c. Size: No. 18 AWG, minimum.
3. Other dc Circuits.
   a. Type: 600-volt, Type MTW stranded copper.
   b. Size: For current carried, but not less than No. 18 AWG.
4. Wire Identification: Numbered and tagged at each termination.
   a. Wire Tags: Machine printed, heat shrink.

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B. Terminate and identify wires entering or leaving enclosures as follows:

1. Analog and Discrete Signal: Terminate at numbered terminal blocks.
2. Identify wiring with wire tags.

C. Terminal Blocks for Enclosures:

1. Quantity:
   a. Accommodate present and spare indicated needs.
   b. Wire spare PLC I/O points to terminal blocks.
   c. One wire per terminal for field wires entering enclosures.
   d. Maximum of two wires per terminal for No. 18 AWG wire for internal enclosure wiring.
   e. Spare Terminals: 10 percent of connected terminals for new panel, but not less than five per terminal block.
2. Terminal Block Types: Reference Section 40 91 00, Instrumentation and Control Components, Part 2, Article Electrical Components.

D. Grounding of Enclosures:

1. Furnish isolated copper grounding bus for signal and shield ground connections.
2. Ground this ground bus at a common signal ground point in accordance with National Electrical Code requirements.
3. Single Point Ground for Each Analog Loop:
   a. Locate signal ground at dc power supply for loop.
   b. Use to ground wire shields for loop.
4. Ground terminal block rails to ground bus.

E. Intrinsic Safety System Installation:

1. Comply with NEC Article 504, Intrinsically Safe Systems.
2. Install intrinsically safe circuits in a separate wire way that is separated from nonintrinsically safe circuits as specified by NEC.

F. Wiring Interface: Terminate and identify wiring entering or leaving enclosures.

1. Analog and Discrete Signal Wires: Terminate at numbered terminal blocks.

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2.06 PANEL FABRICATION

A. General:

1. Nominal Panel Dimensions: Size to suite installed components.
2. Panel Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), state and local codes, and applicable sections of NEMA, ANSI, UL, and ICECA.
3. Fabricate panels, install instruments and wire, and plumb at PIC System Integrator's facility. No fabrication other than correction of minor defects or minor transit damage permitted onsite.
4. UL Listing Mark for Enclosures: Mark stating, "Listed Enclosed Industrial Control Panel," per UL 508A.
5. Electrical Work: In accordance with the applicable requirements of Division 26, Electrical.

B. Temperature Control:

1. Panel: Size to adequately dissipate heat from equipment mounted inside panel and on panel face.

C. Control Panel Electrical:

1. Power Distribution within Panels:
    a. Feeder Circuits:
        1) One or more 120V ac, 60-Hz feeder circuits as shown on Drawings.
        2) Make provisions for feeder circuit conduit entry.
        3) Furnish terminal block for termination of wires.
    b. Power Panel: Furnish main circuit breaker and circuit breaker on each individual branch circuit distributed from power panel.
        1) Locate to provide clear view of and access to breakers when door is open.
        2) Breaker Sizes: Coordinate such that fault in branch circuit will blow only branch breaker, but not trip main breaker.
            a) Branch Circuit Breakers: 15 amps at 250V ac.
        3) Breaker Manufacturers and Products: Refer to Division 26, Electrical.
    c. Circuit Wiring:
        1) P&IDs and Control Diagrams on Drawings show function only. Use following rules for actual circuit wiring:
            a) Devices on Single Circuit: 20, maximum.

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b) Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group all units on same branch circuit.
c) Branch Circuit Loading: 12 amperes continuous, maximum.
d) Panel Lighting and Service Outlets: Put on separate 15 amp, 120V ac branch circuit.
e) Provide 120V ac plugmold for panel components with line cords.

2. Signal Distribution:
   a. Signal Wiring: Separate analog signal cables from power and control within a panel and cross at right angles where necessary.
   b. Within Panels: 4 mA to 20 mA dc signals may be distributed as 1V dc to 5V dc.
   c. Outside Panels: Isolated 4 mA dc to 20 mA dc only.
   d. Signal Wiring: Twisted shielded pairs.
3. Signal Switching:
   a. Use dry circuit type relays or switches.
   b. No interruption of 4 mA to 20 mA loops during switching.
   c. Switching Transients in Associated Signal Circuit:
      1) 4 mA to 20 mA dc Signals: 0.2 mA, maximum.
      2) 1V dc to 5V dc Signals: 0.05V, maximum.
4. Relay Types: Reference Section 40 91 00, Instrumentation and Control Components, Part 2, Article Electrical Components.
5. Standard Light Colors and Inscriptions:
   a. Use following color code and inscriptions for service legends and lens colors for indicating lights, unless otherwise noted in individual Loop Specifications:

Tag Function	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	White

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Tag Function	Inscription(s)	Color
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow

b. Lettering Color:
   1) Black on white and amber lenses.
   2) White on red and green lenses.

D. PIC Enclosure Internal Wiring:

1. Restrain by plastic ties or ducts or metal raceways.
2. Hinge Wiring: Secure at each end so bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
4. Provide abrasion protection for wire bundles that pass through holes or across edges of sheet metal.
5. Connections to Screw Type Terminals:
   a. Locking-fork-tongue or ring-tongue lugs.
   b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.
   c. Wires terminated in a crimp lug, maximum of one.
   d. Lugs installed on a screw terminal, maximum of two.
6. Connections to Compression Clamp Type Terminals:
   a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.
   b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.
7. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.
8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.
9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
11. Plastic Wire Duct Fill: Do not exceed manufacturer's recommendations.

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12. Harness Wiring:
    a. 120V ac: No. 14 AWG, MTW.
    b. 24V dc: No. 16 AWG, MTW where individual conductors are used and Type TC shielded tray cable where shielded wire is used.
13. Panelwork:
    a. No exposed connections.
    b. Allow adjustments to equipment to be made without exposing these terminals.
    c. For power and control wiring operating above 80V ac or dc use covered channels or EMT raceways separate from low voltage signal circuits.
14. Plastic Wire Ducts Color:
    a. 120V ac: White.
    b. 24V dc: Gray.
    c. Communications Cables and Fiber Optic Jumpers: Orange.
15. Make plastic wire ducts the same depth.
16. Provide a minimum of 1-1/2 inches between plastic wire ducts and terminal blocks.

E. Control Relay Arrangement: Install control relays associated with specific loops in same panel section as corresponding terminal blocks or side panels. Provide 20 percent space for future relays. Locate spare space in same sections as spare terminal blocks.

F. Factory Finishing:

1. Furnish materials and equipment with manufacturer's standard finish system and in accordance with Section 09 90 00, Painting and Coating.
2. Use specific color if indicated. Otherwise use manufacturer's standard finish color, or light gray if manufacturer has no standard color.
3. Stainless Steel and Aluminum: Not painted.
4. Nonmetallic Panels: Not painted.

2.07 SOURCE QUALITY CONTROL

A. General:

1. Engineer may actively participate in many of the tests.
2. Engineer reserves right to test or retest specified functions.
3. Engineer's decision will be final regarding acceptability and completeness of testing.

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4. Procedures, Forms, and Checklists:
    a. Except for Unwitnessed Factory Test, conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
    b. Describe each test item to be performed.
    c. Have space after each test item description for sign off by appropriate party after satisfactory completion.
5. Required Test Documentation: Test procedures, forms, and checklists signed by Engineer and Contractor.
6. Conducting Tests:
    a. Provide special testing materials and equipment.
    b. Wherever possible, perform tests using actual process variables, equipment, and data.
    c. If not practical to test with real process variables, equipment, and data provide suitable means of simulation.
    d. Define simulation techniques in test procedures.
    e. Test Format: Cause and effect.
        1) Person conducting test initiates an input (cause).
        2) Specific test requirement is satisfied if correct result (effect), occurs.

B. Unwitnessed Factory Test:

1. Scope: Inspect and test PIC to ensure it is operational, prior to shipment.
2. Location: PIC System Integrator’s facility.
3. Integrated Test:
    a. Exercise and test functions.
    b. Provide stand-alone testing of panel.
    c. Simulate inputs and outputs for primary elements, final control elements, and panels excluded from test.

PART 3 EXECUTION

3.01 EXAMINATION

A. For equipment not provided by PIC System Integrator, but that directly interfaces with PIC, verify the following conditions:

1. Proper installation.
2. Correct control action.
3. Switch settings and dead bands.
4. Opening and closing speeds and travel stops.
5. Input and output signals.

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3.02 INSTALLATION

A. Material and Equipment Installation: Follow manufacturers' installation instructions, unless otherwise indicated or directed by Engineer.

3.03 FIELD QUALITY CONTROL

A. General:

1. Coordinate PIC testing with Owner and affected Subcontractors.
2. Notify Engineer of Performance Test schedule 4 weeks prior to start of test.
3. Engineer may actively participate in tests.
4. Engineer reserves right to test or retest specified functions.
5. Engineer's decision will be final regarding acceptability and completeness of testing.

B. Onsite Supervision:

1. Require PIC System Integrator to observe PIC equipment installation to extent required in order to provide Certificates of Proper Installation.
2. Require PIC site representative to supervise and coordinate onsite PIC activities.
3. Require PIC site representative to be onsite while onsite work covered by this section and PIC subsystems is in progress.

C. Testing Sequence:

1. Provide all Functional Tests and Performance Tests for facilities as required to support staged construction and startup of plant.
2. Refer to Article Work Sequence under Section 01 31 13, Project Coordination, for a definition of project milestones.
3. Refer to Section 01 91 14, Equipment Testing and Facility Startup, for overall testing requirements.
4. Completion: When tests (except Functional Test) have been completed and required test documentation has been accepted.

D. Testing:

1. Prior to Facility Startup and Performance Evaluation period for each facility, inspect, test, and document that associated PIC equipment is ready for operation. Divide Functional Test for each facility into two parts.

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2. Functional Test Part 1: Performed by PIC System Integrator to test and document PIC, excluding applications software, is ready for operation. Provide sufficient temporary software configuring to allow testing.
    a. Loop/Component Inspections and Tests:
        1) These inspections and tests will be spot checked by Engineer.
        2) Check PIC for proper installation, calibration, and adjustment on loop-by-loop and component-by-component basis.
        3) Provide space on forms for signoff by PIC System Integrator.
        4) Use loop status report to organize and track inspection, adjustment, and calibration of each loop and include the following:
            a) Project name.
            b) Loop number.
            c) Tag number for each component.
            d) Checkoffs/Signoffs for Each Component:
                (1) Tag/identification.
                (2) Installation.
                (3) Termination wiring.
                (4) Termination tubing.
                (5) Calibration/adjustment.
            e) Checkoffs/Signoffs for the Loop:
                (1) Panel interface terminations.
                (2) I/O interface terminations with PLCs.
            f) I/O Signals for PLCs are Operational: Received/sent, processed, adjusted.
            g) Total loop operational.
            h) Space for comments.
        5) Component calibration sheet for each active I&C component (except simple hand switches, lights, gauges, and similar items) and each PLC I/O module and include the following:
            a) Project name.
            b) Loop number.
            c) Component tag number or I/O module number.
            d) Component code number for I&C elements.
            e) Manufacturer for I&C elements.
            f) Model number/serial number for I&C elements.
            g) Summary of Functional Requirements; for Example:
                (1) Indicators and recorders, scale and chart ranges.
                (2) Transmitters/converters, input and output ranges.

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(3) Computing elements' function.
(4) Controllers, action (direct/reverse) and control modes (P, I, D).
(5) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
(6) I/O Modules: Input or output.

h) Calibrations, for example, but not limited to:
(1) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
(2) Discrete Devices: Actual trip points and reset points.
(3) Controllers: Mode settings (P&ID).
(4) I/O Modules: Actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling.
(5) Space for comments.

b. Maintain loop status reports, valve adjustment sheets, and component calibration sheets at Site, and make them available to Engineer at all times.
c. Engineer reviews loop status sheets and component calibration sheets and spot-check their entries periodically, and upon completion of Preparation for Testing. Correct deficiencies found.
d. Forms: See Loop Status Report, Instrument Calibration Sheet, and I&C Valve Adjustment Sheet referenced in Article Supplements.

3. Functional Test Part 2: Combined effort between Contractor, PIC System Integrator, Application Software Integrator of Record, and Engineer to confirm PIC, including applications software, is ready for operation.
a. Prerequisite: Completion of Functional Test Part 1.
b. Joint test with Engineer. Repeat of Application Software Integrator of Record's application software tests, except using real field sensors and equipment. Plant interlocking and communications with PLCs and HMIs tested on loop-by-loop basis.
c. Test procedures provided by Application Software Integrator of Record based on Functional Test Part 1 and application software tests.
d. Completed when Functional Test has been conducted and Engineer has spot-checked associated test forms and checklists in field.

4. Functional Test:
a. Scope: Confirm PIC, including applications software, is ready for operation.

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b. Refer to PIC subsections for additional requirements.
c. Completed when Functional Test has been conducted and Engineer has spot-checked associated test forms and checklists in field.

5. Required Test Documentation: Test procedures, forms, and checklists. Signed by Engineer and Contractor except for Functional Test items signed only by Contractor.

E. Performance Test During and After Facility Startup:

1. Once a facility's Functional Test has been completed and that facility has been started up, perform a witnessed Performance Test jointly with Engineer on associated PIC equipment to demonstrate that it is operating as required by Contract Documents. Demonstrate each required function on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.
2. Loop-specific and nonloop-specific tests except that entire installed PIC tested using actual process variables and functions demonstrated.
3. Perform local and manual tests for each loop before proceeding to remote and automatic modes.
4. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.
5. Make updated versions of documentation required for Performance Test available to Engineer at Site, both before and during tests.
6. Make O&M data available to Engineer at Site both before and during testing.
7. Follow daily schedule required by Contractor.
8. Determination of Ready for Operation: When Functional Test has been completed.
9. Refer to examples of Performance Test procedures and forms in Article Supplements.

3.04 TRAINING

A. General:

1. Owner training by PIC System Integrator in coordination with Owner and Contractor in accordance with Section 01 43 33, Manufacturers' Field Services.

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2. Provide an integrated training program for Owner's personnel.
3. Perform training to meet specific needs of Owner's personnel.
4. Include training sessions, classroom and field, for operators and maintenance personnel.
5. Provide instruction on two working shift(s) as needed to accommodate the Owner's personnel schedule.
6. Owner reserves the right to reuse videotapes of training sessions.

B. Operations and Maintenance Training:

1. General:
    a. Refer to specific requirements specified in PIC Subsections.
    b. Include review of O&M data and survey of spares, expendables, and test equipment.
    c. Use equipment similar to that provided.
    d. Unless otherwise specified in PIC subsections, provide training suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent education and experience in electronics, instrumentation, or digital systems.
2. Operations Training: For Owner's operations personnel on operation of I&C components.
    a. Training Session Duration: 2 hours.
    b. Number of Training Sessions: Two.
    c. Location: Project Site.
    d. Course Objective: Develop skills needed to use I&C components and functions to monitor and control the plant on a day-to-day basis.
    e. Content: Conduct training on loop-by-loop basis.
        1) Loop Functions: Understanding of loop functions, including interlocks for each loop.
        2) Loop Operation: For example, adjusting process variable setpoints, AUTO/MANUAL control transfer, AUTO and MANUAL control, annunciator acknowledgement and resetting.
        3) Interfaces with PIC subsystems.
3. Maintenance Training:
    a. Training Session Duration: 2 hours.
    b. Number of Training Sessions: Two.
    c. Location: Project Site.
    d. Course Objective: Develop skills needed for routine maintenance of PIC.

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e. Content: Provide training for each type of component and function provided.
   1) Loop Functions: Understanding details of each loop and how they function.
   2) Component calibration.
   3) Adjustments: Switch trip points, and similar items.
   4) Troubleshooting and diagnosis for equipment and software.
   5) Replacing lamps and fuses.
   6) I&C components removal and replacement.
   7) Periodic preventive maintenance.

3.05 CLEANING

A. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.06 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. I/O List.
2. Instrument List.
3. Control Loop Descriptions.

END OF SECTION

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I/O LIST

Equipment #	Title	PLC	Panel	Node	Slot	PLC Address	TS/Term #	Field Wire #	PID	Zero State Low Range	One State High Range	IO Type
210-M-2111A	PRIMARY SLUDGE COLLECTOR 1	PLC01	CP-1	7	15	Q 9.0	TS-12/241/242	Y201/Y201-C	100-N-60		RUN	DO(R)
210-M-2111A	PRIMARY SLUDGE COLLECTOR 1	PLC01	CP-1	7	8	I 6.6	TS-12/215	X54	100-N-60	OFF	RUNNING	DI(R)
210-M-2111A	PRIMARY SLUDGE COLLECTOR 1	PLC01	CP-1	7	10	I 15.0	TS-12/269	X120	100-N-60	LOCAL	REMOTE	DI(R)
210-QS-2111A	PRIMARY SLUDGE COLLECTOR 1	PLC01	CP-1	7	10	I 12.2	TS-12/163	X98	100-N-60	NORMAL	HI TORQUE	DI(R)
210-M-2112A	PRIMARY SLUDGE COLLECTOR 2	PLC01	CP-1	7	15	Q 9.1	TS-12/243/244	Y202/Y202-C	100-N-60		RUN	DO(R)
210-M-2112A	PRIMARY SLUDGE COLLECTOR 2	PLC01	CP-1	7	8	I 6.7	TS-12/216	X55	100-N-60	OFF	RUNNING	DI(R)
210-M-2112A	PRIMARY SLUDGE COLLECTOR 2	PLC01	CP-1	7	10	I 15.1	TS-12/270	X121	100-N-60	LOCAL	REMOTE	DI(R)
210-QS-2112A	PRIMARY SLUDGE COLLECTOR 2	PLC01	CP-1	7	10	I 12.3	TS-12/164	X99	100-N-60	NORMAL	HI TORQUE	DI(R)
210-M-2113A	PRIMARY SLUDGE COLLECTOR 3	PLC01	CP-1	7	15	Q 9.2	TS-12/245/246	Y203/Y203-C	100-N-60		RUN	DO(R)
210-M-2113A	PRIMARY SLUDGE COLLECTOR 3	PLC01	CP-1	7	8	I 7.0	TS-12/217	X56	100-N-60	OFF	RUNNING	DI(R)
210-M-2113A	PRIMARY SLUDGE COLLECTOR 3	PLC01	CP-1	7	10	I 15.2	TS-12/271	X122	100-N-60	LOCAL	REMOTE	DI(R)
210-QS-2113A	PRIMARY SLUDGE COLLECTOR 3	PLC01	CP-1	7	10	I 12.4	TS-12/165	X100	100-N-60	NORMAL	HI TORQUE	DI(R)
210-M-2114A	PRIMARY SLUDGE COLLECTOR 4	PLC01	CP-1	7	15	Q 9.3	TS-12/247/248	Y204/Y204-C	100-N-60		RUN	DO(R)
210-M-2114A	PRIMARY SLUDGE COLLECTOR 4	PLC01	CP-1	7	8	I 7.1	TS-12/218	X57	100-N-60	OFF	RUNNING	DI(R)
210-M-2114A	PRIMARY SLUDGE COLLECTOR 4	PLC01	CP-1	7	10	I 15.3	TS-12/272	X123	100-N-60	LOCAL	REMOTE	DI(R)
210-QS-2114A	PRIMARY SLUDGE COLLECTOR 4	PLC01	CP-1	7	10	I 12.5	TS-12/166	X101	100-N-60	NORMAL	HI TORQUE	DI(R)
210-M-2115A	PRIMARY SLUDGE COLLECTOR 5	PLC01	CP-1	7	15	Q 9.5	TS-12/251/252	Y206/Y206-C	100-N-60		RUN	DO(R)
210-M-2115A	PRIMARY SLUDGE COLLECTOR 5	PLC01	CP-1	7	8	I 7.2	TS-12/219	X58	100-N-60	OFF	RUNNING	DI(R)
210-M-2115A	PRIMARY SLUDGE COLLECTOR 5	PLC01	CP-1	7	10	I 15.4	TS-12/273	X124	100-N-60	LOCAL	REMOTE	DI(R)
210-QS-2115A	PRIMARY SLUDGE COLLECTOR 5	PLC01	CP-1	7	10	I 12.6	TS-12/167	X102	100-N-60	NORMAL	HI TORQUE	DI(R)
210-M-2116A	PRIMARY SLUDGE COLLECTOR 6	PLC01	CP-1	7	15	Q 9.6	TS-12/253/254	Y207/Y207-C	100-N-60		RUN	DO(R)
210-M-2116A	PRIMARY SLUDGE COLLECTOR 6	PLC01	CP-1	7	8	I 7.3	TS-12/220	X59	100-N-60	OFF	RUNNING	DI(R)
210-M-2116A	PRIMARY SLUDGE COLLECTOR 6	PLC01	CP-1	7	10	I 15.5	TS-12/274	X125	100-N-60	LOCAL	REMOTE	DI(R)
210-QS-2116A	PRIMARY SLUDGE COLLECTOR 6	PLC01	CP-1	7	10	I 12.7	TS-12/168	X103	100-N-60	NORMAL	HI TORQUE	DI(R)
210-M-2111B	SLUDGE CROSS COLLECTOR 1	PLC01	CP-1	7	13	Q 4.0	TS-11/25/26	Y161/Y161-C	100-N-60		RUN	DO
210-M-2111B	SLUDGE CROSS COLLECTOR 1	PLC01	CP-1	7	7	I 0.3	TS-11/4	X3	100-N-60	OFF	RUNNING	DI
210-M-2111B	SLUDGE CROSS COLLECTOR 1	PLC01	CP-1	7	7	I 1.1	TS-11/10	X9	100-N-60	LOCAL	REMOTE	DI
210-QS-2111B	SLUDGE CROSS COLLECTOR 1	PLC01	CP-1	7	10	I 13.0	TS-12/169	X104	100-N-60	NORMAL	HI TORQUE	DI
210-M-2112B	SLUDGE CROSS COLLECTOR 2	PLC01	CP-1	7	13	Q 4.1	TS-11/27/28	Y162/Y162-C	100-N-60		RUN	DO
210-M-2112B	SLUDGE CROSS COLLECTOR 2	PLC01	CP-1	7	7	I 0.4	TS-11/5	X4	100-N-60	OFF	RUNNING	DI
210-M-2112B	SLUDGE CROSS COLLECTOR 2	PLC01	CP-1	7	7	I 1.2	TS-11/11	X10	100-N-60	LOCAL	REMOTE	DI
210-QS-2112B	SLUDGE CROSS COLLECTOR 2	PLC01	CP-1	7	10	I 13.1	TS-12/170	X105	100-N-60	NORMAL	HI TORQUE	DI
210-M-2113B	SLUDGE CROSS COLLECTOR 3	PLC01	CP-1	7	13	Q 4.2	TS-11/29/30	Y163/Y163-C	100-N-60		RUN	DO
210-M-2113B	SLUDGE CROSS COLLECTOR 3	PLC01	CP-1	7	7	I 0.5	TS-11/6	X5	100-N-60	OFF	RUNNING	DI
210-M-2113B	SLUDGE CROSS COLLECTOR 3	PLC01	CP-1	7	7	I 1.3	TS-11/12	X11	100-N-60	LOCAL	REMOTE	DI
210-QS-2113B	SLUDGE CROSS COLLECTOR 3	PLC01	CP-1	7	10	I 13.2	TS-12/171	X106	100-N-60	NORMAL	HI TORQUE	DI
210-M-2114B	SLUDGE CROSS COLLECTOR 4	PLC01	CP-1	7	13	Q 4.3	TS-11/31/32	Y164/Y164-C	100-N-60		RUN	DO
210-M-2114B	SLUDGE CROSS COLLECTOR 4	PLC01	CP-1	7	7	I 0.6	TS-11/7	X6	100-N-60	OFF	RUNNING	DI
210-M-2114B	SLUDGE CROSS COLLECTOR 4	PLC01	CP-1	7	7	I 1.4	TS-11/13	X12	100-N-60	LOCAL	REMOTE	DI
210-QS-2114B	SLUDGE CROSS COLLECTOR 4	PLC01	CP-1	7	10	I 13.3	TS-12/172	X107	100-N-60	NORMAL	HI TORQUE	DI

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I/O LIST

Equipment #	Title	PLC	Panel	Node	Slot	PLC Address	TS/Term #	Field Wire #	PID	Zero State Low Range	One State High Range	IO Type
210-M-2115B	SLUDGE CROSS COLLECTOR 5	PLC01	CP-1	7	13	Q 4.4	TS-11/33/34	Y165/Y165-C	100-N-60		RUN	DO
210-M-2115B	SLUDGE CROSS COLLECTOR 5	PLC01	CP-1	7	7	I 0.7	TS-11/8	X7	100-N-60	OFF	RUNNING	DI
210-M-2115B	SLUDGE CROSS COLLECTOR 5	PLC01	CP-1	7	7	I 2.5	TS-11/46	X21	100-N-60	LOCAL	REMOTE	DI
210-QS-2115B	SLUDGE CROSS COLLECTOR 5	PLC01	CP-1	7	10	I 15.6	TS-12/275	X126	100-N-60	NORMAL	HI TORQUE	DI
210-M-2116B	SLUDGE CROSS COLLECTOR 6	PLC01	CP-1	7	13	Q 4.6	TS-11/37/38	Y167/Y167-C	100-N-60		RUN	DO
210-M-2116B	SLUDGE CROSS COLLECTOR 6	PLC01	CP-1	7	7	I 1.0	TS-11/9	X8	100-N-60	OFF	RUNNING	DI
210-M-2116B	SLUDGE CROSS COLLECTOR 6	PLC01	CP-1	7	7	I 2.6	TS-11/47	X22	100-N-60	LOCAL	REMOTE	DI
210-QS-2116B	SLUDGE CROSS COLLECTOR 6	PLC01	CP-1	7	10	I 15.7	TS-12/276	X127	100-N-60	NORMAL	HI TORQUE	DI
210-SF-2101/02	SUPPLY FANS RUNNING INDICATION	PLC	420-CP-010						100-N-61	OFF	BOTH ON	DO
210-LCP-2100	GO/NO-GO SYSTEM	PLC	420-CP-010						100-N-61	NORMAL	ALARM	DI
210-SF-2101	SUPPLY FAN 1	PLC	420-CP-010						100-N-61	OFF	RUNNING	DI
210-SF-2102	SUPPLY FAN 2	PLC	420-CP-010						100-N-61	OFF	RUNNING	DI

I/O Type Legend	Count	Notes
DI: Discrete Input	39	(R) indicates point to be reused, including field wiring
DO: Discrete Output	13	(R) indicates point to be reused, including field wiring

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INSTRUMENT LIST

Tag Number	Comp. Code	Component Title and Features	P&ID	Installation Detail
210-AIT-2100	A10	COMBUSTIBLE GAS ELEMENT AND TRANSMITTER Alarm Relay Setpoint: 10% LEL	100-N-61	Wall mount; Remote Sensor mounted at high point
210-YL-2100A	M31	GO/NO-GO WARNING LIGHT Two Segment Outside Door 1	100-N-61	Wall mount
210-YL-2100B	M31	GO/NO-GO WARNING LIGHT Two Segment Outside Door 2	100-N-61	Wall mount
210-YL-2100C	M31	GO/NO-GO WARNING LIGHT Two Segment Outside Door 3	100-N-61	Wall mount
210-YL-2100D	M31	GO/NO-GO WARNING LIGHT Two Segment Outside Door 4	100-N-61	Wall mount
210-YL-2100E	M31	GO/NO-GO WARNING LIGHT Two Segment Inside, Class 1, Division 2	100-N-61	Wall mount
210-XA-2100	M30	HORN, INDOOR/OUTDOOR Class 1, Division 2	100-N-61	Surface Mount

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Control Loop Description	Primary Clarifiers Sludge Collection

Overview:

This loop description covers the operation of Facility 210 primary clarifiers. Each of the six primary clarifier basins include an influent gate, longitudinal sludge collection mechanism, cross sludge collection mechanism, and scum skimmer mechanism.

Process Description:

Each of the six primary clarifiers consist of a basin with two individual sludge collection mechanisms (one longitudinal collector and one cross collector). The primary clarifiers receive primary influent (that has been screened and passed through aerated grit removal process) that settles and is collected in the sludge collection hopper at the influent end of the basin. The primary sludge pump pumps primary sludge from this hopper to the digester feed tank during normal operation, or directly to the online digesters. These pump systems control the rate of sludge removed from the clarifier and conveyed to the digester feed tank.

The longitudinal collectors run continuously when a basin is online.

There will be one duty longitudinal sludge collector and one duty cross sludge collector. Collectors will be constant speed. The longitudinal collector will run continuously when the basin is in service. The cross collector will start running when the associated primary sludge pump starts. The cross collector will stop after a set time delay, after the associated primary sludge pump stops. The time period will be operator adjustable.

Re-use existing controls for Helical Scum Skimmers. Scum skimmers will run on an operator adjustable timer.

Reference Drawing(s):	P&ID: 210-N-060		
Last Update/Review:		**Approved By:**	

Equipment

Unit Equipment:

Tag No.	Description	Notes
340-2111A	Longitudinal Collector 1	
340-2111B	Cross Collector 1	
350-2111	Helical Scum Skimmer 1	
340-2112A	Longitudinal Collector 2	
340-2112B	Cross Collector 2	
350-2112	Helical Scum Skimmer 2	
340-2113A	Longitudinal Collector 3	
340-2113B	Cross Collector 3	
350-2113	Helical Scum Skimmer 3	
340-2114A	Longitudinal Collector 4	
340-2114B	Cross Collector 4	
350-2114	Helical Scum Skimmer 4	

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	340-2115A	Longitudinal Collector 5	
	340-2115B	Cross Collector 5	
	350-2115	Helical Scum Skimmer 5	
	340-2116A	Longitudinal Collector 6	
	340-2116B	Cross Collector 6	
	350-2116	Helical Scum Skimmer 6	

Instrumentation:

Tag No.	Description	Notes
340-QS2111A	Long Collector 1 Hi-Hi Torque Switch	
340-HS2111A	Long Collector 1 HOA Handswitch	
340-QS2111B	Cross Collector 1 Hi-Hi Torque Switch	
340-HS2111B	Cross Collector 1 HOA Handswitch	
340-QS2112A	Long Collector 2 Hi-Hi Torque Switch	
340-HS2112A	Long Collector 2 HOA Handswitch	
340-QS2112B	Cross Collector 2 Hi-Hi Torque Switch	
340-HS2112B	Cross Collector 2 HOA Handswitch	
340-QS2113A	Long Collector 3 Hi-Hi Torque Switch	
340-HS2113A	Long Collector 3 HOA Handswitch	
340-QS2113B	Cross Collector 3 Hi-Hi Torque Switch	
340-HS2113B	Cross Collector 3 HOA Handswitch	
340-QS2114A	Long Collector 4 Hi-Hi Torque Switch	
340-HS2114A	Long Collector 4 HOA Handswitch	
340-QS2114B	Cross Collector 4 Hi-Hi Torque Switch	
340-HS2114B	Cross Collector 4 HOA Handswitch	
340-QS2115A	Long Collector 5 Hi-Hi Torque Switch	
340-HS2115A	Long Collector 5 HOA Handswitch	
340-QS2115B	Cross Collector 5 Hi-Hi Torque Switch	
340-HS2115B	Cross Collector 5 HOA Handswitch	
340-QS2116A	Long Collector 6 Hi-Hi Torque Switch	
340-HS2116A	Long Collector 6 HOA Handswitch	
340-QS2116B	Cross Collector 6 Hi-Hi Torque Switch	
340-HS2116B	Cross Collector 6 HOA Handswitch	

Control Strategies

When a basin is brought online, operators will begin by opening the influent gate to slowly fill the basin. Once the clarifier is full, the cross collector and long collector will be brought online.

The longitudinal sludge collector will run continuously, when in service.

When the cross collector is in AUTO (SCADA), it will run intermittently. The cross collector will run and convey sludge to the pump suction when the associated primary sludge pump is called to run. The cross collector will stop when the associated primary sludge pump stops.

If the shear pin on a collector drive breaks, a high torque switch will cut out the associated drive motor.

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Basin influent gate and helical scum skimmer control will remain un-altered.

All Modes

Longitudinal collectors will run continuously when called to run.

Local Control Operation and Alarm Reset

VFD Control Panel

NA

Motor Control Center

Long Collectors

- ON/OFF Indication
- ALARM Indication

Cross Collectors

- ON/OFF Indication
- ALARM Indication

MFR Control Center

NA

Local Control Station

Long Collectors

- HOA hand switch
- RESET Push button
- RUN Indication
- Fault Indication

Cross Collectors

- HOA hand switch
- RESET Push button
- RUN Indication
- Fault Indication

SCADA Control Operation and Alarm Reset

SCADA Manual

Each sludge collector that is placed in auto mode at the local control station (LCS) may be run in SCADA MANUAL mode from the plant HMI. When the sludge collector is in ATUO (SCADA) mode and in manual on the plant HMI, the operator can start and stop the collector at HMI terminal.

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SCADA Auto

The longitudinal collector will run continuously.

The cross collector will be called to run when the associated primary sludge pump is called to run. The cross collector will turn off after a set time delay, after the associated primary sludge pump stops. The time period will be operator adjustable.

Helical scum skimmers will be called to run on a timer. The duration and frequency will be operator adjustable setpoints.

If a clarifier is taken out of service, the operator must manually remove the collectors from service. If a high-high torque level is reached, an alarm will alert at SCADA and the associated collector will shut off. If a cross collector is disabled or run status feedback is not detected after a short time delay when the associated primary sludge pump is running, an alarm will alert at SCADA.

SCADA Display

Status and Process Display

SCADA HMI GRAPHICS

The HMI will use WES TC plant standard face plate HMI graphics and corresponding PLC function blocks as described below.

Function block MTR_SS and the corresponding HMI face plate provide all indications, alarms, and operator inputs for a constant speed motor.

Function block ANLG_IN1 and the corresponding HMI face plate provide analog value display and operator control over all analog alarm set points, as well as enabling and disabling individual alarms.

Function block DSCR_IN1 provides processing of digital input, alarm generation, alarm time delay for discrete data.

Item	Tag	PLC Function Block	HMI Graphic
Long Collector 1	TC01_210_340_M_2111A	FB321 (MTR_SS)	Constant speed motor pop up
Cross Collector 1	TC01_210_340_M_2111B	FB321 (MTR_SS)	Constant speed motor pop up
QSH 2111A	TC01_210_340_QSH_2111A	FB301 (DSCR_IN1)	Alarm indication only
QSH 2111B	TC01_210_340_QSH_2111B	FB301 (DSCR_IN1)	Alarm indication only
Long Collector 2	TC01_210_340_M_2112A	FB321 (MTR_SS)	Constant speed motor pop up
Cross Collector 2	TC01_210_340_M_2112B	FB321 (MTR_SS)	Constant speed motor pop up
QSH 2112A	TC01_210_340_QSH_2112A	FB301 (DSCR_IN1)	Alarm indication only

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QSH 2112B	TC01_210_340_QSH_2112B	FB301 (DSCR_IN1)	Alarm indication only
Long Collector 3	TC01_210_340_M_2113A	FB321 (MTR_SS)	Constant speed motor pop up
Cross Collector 3	TC01_210_340_M_2113B	FB321 (MTR_SS)	Constant speed motor pop up
QSH 2113A	TC01_210_340_QSH_2113A	FB301 (DSCR_IN1)	Alarm indication only
QSH 2113B	TC01_210_340_QSH_2113B	FB301 (DSCR_IN1)	Alarm indication only
Long Collector 4	TC01_210_340_M_2114A	FB321 (MTR_SS)	Constant speed motor pop up
Cross Collector 4	TC01_210_340_M_2114B	FB321 (MTR_SS)	Constant speed motor pop up
QSH 2114A	TC01_210_340_QSH_2114A	FB301 (DSCR_IN1)	Alarm indication only
QSH 2114B	TC01_210_340_QSH_2114B	FB301 (DSCR_IN1)	Alarm indication only
Long Collector 5	TC01_210_340_M_2115A	FB321 (MTR_SS)	Constant speed motor pop up
Cross Collector 5	TC01_210_340_M_2115B	FB321 (MTR_SS)	Constant speed motor pop up
QSH 2115A	TC01_210_340_QSH_2115A	FB301 (DSCR_IN1)	Alarm indication only
QSH 2115B	TC01_210_340_QSH_2115B	FB301 (DSCR_IN1)	Alarm indication only
Long Collector 6	TC01_210_340_M_2116A	FB321 (MTR_SS)	Constant speed motor pop up
Cross Collector 6	TC01_210_340_M_2116B	FB321 (MTR_SS)	Constant speed motor pop up
QSH 2116A	TC01_210_340_QSH_2116A	FB301 (DSCR_IN1)	Alarm indication only
QSH 2116B	TC01_210_340_QSH_2116B	FB301 (DSCR_IN1)	Alarm indication only

Operator Entries

Remote Auto Setpoints (Preliminary Values):

- NONE

SCADA Alarms and Resets

ALARMS

1. Longitudinal Collector 1-6 High High Torque Switch, run fail, reset at MCC.
2. Cross Collector 1-6 High High Torque Switch, run fail, reset at MCC.

Hard-Wired Interlocks

The sludge collector mechanism will stop if the shear pin shears. This is hardwired into motor starter circuit in MCC bucket.

Software Interlocks

NONE

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Historical Trending and Run-time Counters

Run time for motors.

Equipment Failure Sequence

NONE

Equipment Automatic Failover Sequence

NONE

Equipment (Auto/Manual) Restart After Power Interruption

RESET and MANUAL Restart.

IO Points

Tag	Description	IO Type	PLC
	See P&ID's and IO list.		

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Control Loop Description	Primary Sludge Pumps

Overview:

This loop description covers the control of the six Primary Sludge Pumps in the lower level gallery of Facility 210. Control of the primary sludge pumps to remove primary sludge from the primary clarifier cross collector hopper and send to the digester feed tank or directly to the anaerobic digesters. Pumps are cycled on and off such that no more than one pump is running at a time.

Process Description:

Primary sludge pumping consists of one duty pump per primary clarifier. The primary clarifier longitudinal collector conveys sludge from the effluent end to the sludge hopper at the influent end of the rectangular clarifier. The cross collector, also a chain and flight collector, conveys sludge in the sludge hopper to the primary sludge pump suction at the low point of the hopper. The primary sludge pumps convey primary sludge from to the digester feed tank at the solids handling complex. Primary sludge pumps control the solids removed from the primary clarifiers and the sludge blanket level.

There is one existing duty primary sludge pump per basin. All pumps have a combined discharge header. Pumps are air operated diaphragm (AOD) style positive displacement pumps. Each pump has capacity of 3.8 gallons per stroke at full stroke. When operated at 8 strokes per minute, this results in capacity of 30.4 gpm for each pump.

A pump is placed into service by enabling the pump when the associated clarifier is brought online, setting the pump to AUTO (SCADA) at the local panel and AUTO at SCADA. Sludge blanket level is measured daily by operations staff, and pump run frequency is manually adjusted at the plant supervisory control and data acquisition (SCADA) system. Pumps run for a number of timed cycles each day to maintain a desired sludge blanket level.

Reference Drawing(s):	P&ID: 210-N-001 (1985)		
Last Update/Review:		**Approved By:**	

Equipment

Unit Equipment:

Tag No.	Description	Notes
130-2211	Primary Sludge Pump 1	Existing equipment, 3.8 gallons per stroke
130-2212	Primary Sludge Pump 2	Existing equipment, 3.8 gallons per stroke
130-2213	Primary Sludge Pump 3	Existing equipment, 3.8 gallons per stroke
130-2214	Primary Sludge Pump 4	Existing equipment, 3.8 gallons per stroke
130-2215	Primary Sludge Pump 5	Existing equipment, 3.8 gallons per stroke
130-2216	Primary Sludge Pump 6	Existing equipment, 3.8 gallons per stroke

Instrumentation:

Tag No.	Description	Notes

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Control Strategies

A sequencer selects which pump is running. The sequencer cycles through each available pump and calls the pump to run for an operator-adjustable time period. Each pump has a unique operator entered time period. At the end of each cycle, the sequencer pauses for a set pause time. Individual pump run times can be adjusted based on process needs and operator preference. Operators can override the sequence by commanding a pump to run manually from SCADA, or in HAND at the local pump control panel (LP) for each pump.

When the cycle pause timer has timed out, the first pump in the sequence is called to run. After the target for run time duration is achieved, the pump is stopped and the next pump in sequence is called to run. This repeats until all available pumps have been called to run. After the last pump has stopped, the adjustable cycle pause time is activated before re-starting the cycle from the beginning. A pump is considered not available if it is DISABLED at SCADA HMI or not in AUTO mode at the LP.

Local pressure instrumentation on each pump monitor suction and discharge pressure. Sight glasses are installed for verification of flow. Flow and pressure of the pumped fluid is not monitored or controlled by the control system.

All Modes

When a pump is called to run, existing local timers control individual pump strokes per minute. Timers are currently set to 8 strokes per minute. Each stroke pumps 3.8 gallons. These timers are adjustable locally and are not information available to SCADA.

The pump total flow is calculated by counting strokes and using an assigned value from the gallons per stroke entry at SCADA HMI. This value is set at 3.8 gallons and should not change unless the pumps are re-calibrated. The same value is used for all pumps.

Local Control Operation and Alarm Reset

VFD Control Panel

NA

Motor Control Center

NA

MFR Control Center

NA

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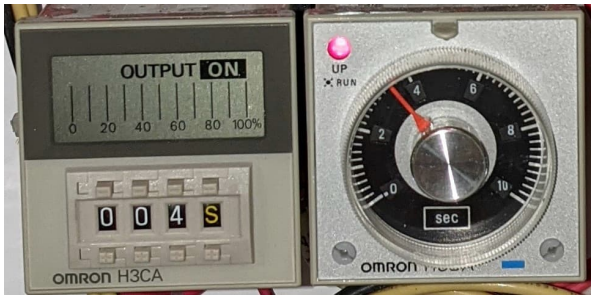
Local Control Station

- HOA handswitch
- ON/OFF indication
- Inside panel are adjustable timers:
  - Left timer adjusts time between strokes (4 seconds)
  - Right timer adjusts stroke time (stroke length) (3.5 seconds)
  - Sum of both timers sets the total time for one stroke (7.5 seconds)
  - Strokes per minute is 60 seconds / 7.5 seconds = 8 strokes per minute



SCADA Control Operation and Alarm Reset

SCADA Manual

Each pump that is placed in AUTO (SCADA) mode at the local pump control panel (LP) may be run in SCADA MANUAL mode from the plant HMI. When the pump is in SCADA MANUAL on the plant HMI, the operator can start and stop the pump at HMI terminal.

SCADA Auto

Each pump that is placed in AUTO (SCADA) mode at the local pump control panel (LP) may be run in SCADA AUTO mode from the plant HMI. In SCADA AUTO mode, the pump runs periodically when called from the sequence cycle, for a set time period (operator adjustable). The automatic sequence controls cycle through each pump, calling them to run one at a time.

At SCADA HMI, a pump run time setpoint for each pump and a cycle pause time are operator adjustable. Pumps are called to run sequentially. Pumps will run for their set run time when called to run. All pumps will be off for the set pause time at the end of the cycle. The cycle repeats continuously.

If a clarifier is taken out of service, the operators must manually remove the associated pump from service, by disabling it from the HMI Pump Popup screen. If a pump is enabled and called to run, but a run feedback is not detected, a pump fail alarm will be generated. When a pump is disabled or has failed, the next pump in the sequence will be called to run when the pump run timer has timed out.

Run timers can be set to zero (0) for pumps that are disabled.

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SCADA Display

Status and Process Display

SCADA HMI GRAPHICS

The HMI will use WES TC plant standard face plate HMI graphics.

Display the calculated total cycle time as the sum of each pump run time setpoint plus the cycle pause time setpoint.

Display the calculated total cycle time remaining.

Operator Entries

Remote Auto Setpoints (all setting in minutes):

- Primary Sludge Pump 1 Run Time
- Primary Sludge Pump 2 Run Time
- Primary Sludge Pump 3 Run Time
- Primary Sludge Pump 4 Run Time
- Primary Sludge Pump 5 Run Time
- Primary Sludge Pump 6 Run Time
- Cycle Pause Time

Common Setpoints (Nominal Values):

- Primary Sludge Pump Capacity (3.8 gallons/stroke)

SCADA Alarms and Resets

ALARMS

1. Primary Sludge Pump 1 Fault
2. Primary Sludge Pump 2 Fault
3. Primary Sludge Pump 3 Fault
4. Primary Sludge Pump 4 Fault
5. Primary Sludge Pump 5 Fault
6. Primary Sludge Pump 6 Fault

Hard-Wired Interlocks

NONE

Software Interlocks

Stop the pumps if the digester feed tank hi-hi level switch is in alarm.

For each primary sludge pump, provide run status to associated cross collector to call the collector to run when in AUTO mode.

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Historical Trending and Run-time Counters

- Run time – each pump
- Daily volume Primary Sludge (calculated) - each pump
- Daily total volume Primary Sludge, sum of all pumps

Equipment Failure Sequence

TBD

Equipment Automatic Failover Sequence

TBD

Equipment (AUTO/MANUAL) Restart After Power Interruption

TBD

IO Points

Tag	Description	IO Type	PLC
	SEE P&ID's		

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SECTION 40 91 00
INSTRUMENTATION AND CONTROL COMPONENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section gives general requirements for instrumentation and control components.

PART 2 PRODUCTS

2.01 GENERAL

A. Article Electrical Components covers requirements for electrical PIC components that are not specifically referenced by Section 40 90 00, Instrumentation and Control for Process Systems.

B. All other Part 2 articles cover components that are referenced by Instrument Lists or Data Sheets in Section 40 90 00, Instrumentation and Control for Process Systems, or by specific component numbers in other PIC subsections.

2.02 ELECTRICAL COMPONENTS

A. Terminal Blocks for Enclosures:

1. General:
   a. Connection Type: Screw compression clamp.
   b. Compression Clamp:
      1) Complies with DIN-VDE 0611.
      2) Hardened steel clamp with transversal grooves that penetrate wire strands providing a vibration-proof connection.
      3) Guides strands of wire into terminal.
   c. Screws: Hardened steel, captive, and self-locking.
   d. Current Bar: Copper or treated brass.
   e. Insulation:
      1) Thermoplastic rated for minus 55 degrees C to plus 110 degrees C.
      2) Two funneled shaped inputs to facilitate wire entry.

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f. Mounting:
   1) Standard DIN rail.
   2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
   3) End Stops: Minimum of one at each end of rail.
g. Wire Preparation: Stripping only permitted.
h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
i. Marking System:
   1) Terminal number shown on both sides of terminal block.
   2) Allow use of preprinted and field marked tags.
   3) Terminal strip numbers shown on end stops.
   4) Mark terminal block and terminal strip numbers as shown on panel control diagrams and loop diagrams.
   5) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.
j. Test Plugs: Soldered connections for 18 AWG wire.
   1) Pin Diameter: 0.079 inch.
   2) Quantity: 10.
   3) Manufacturer: Phoenix Contact.

2. Terminal Block, General Purpose:
   a. Rated Voltage: 600V ac.
   b. Rated Current: 30 amp.
   c. Wire Size: 24 AWG to 10 AWG.
   d. Rated Wire Size: 10 AWG.
   e. Color: Gray body.
   f. Spacing: 0.25 inch, maximum.
   g. Test Sockets: One screw test socket 0.079-inch diameter.
   h. Manufacturer: Phoenix Contact.
3. Terminal Block, Ground:
   a. Wire Size: 24 AWG to 10 AWG.
   b. Rated Wire Size: 10 AWG.
   c. Color: Green and yellow body.
   d. Spacing: 0.25 inch, maximum.
   e. Grounding: Electrically grounded to mounting rail.
   f. Manufacturer: Phoenix Contact.
4. Terminal Block, Blade Disconnect Switch:
   a. Rated Voltage: 600V ac.
   b. Rated Current: 10 amp.
   c. Wire Size: 22 AWG to 10 AWG.
   d. Rated Wire Size: 10 AWG.
   e. Color: Gray body, orange switch.
   f. Spacing: 0.25 inch, maximum.
   g. Manufacturer: Phoenix Contact.

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5. Terminal Block, Fused, 120V ac:
    a. Rated Voltage: 600V ac.
    b. Rated Current: 25 amp.
    c. Wire Size: 22 AWG to 10 AWG.
    d. Rated Wire Size: 10 AWG.
    e. Color: Gray body.
    f. Fuse: 0.25 inch by 1.25 inches.
    g. Indication: Neon lamp, 110V ac.
    h. Leakage Current: 1.8 mA, maximum.
    i. Spacing: 0.512 inch, maximum.
    j. Manufacturer: Phoenix Contact.

B. Relays:

1. General:
    a. Relay Mounting: Plug-in type socket.
    b. Relay Enclosure: Furnish dust cover.
    c. Socket Type: Screw terminal interface with wiring.
    d. Socket Mounting: Rail.
    e. Provide holddown clips.
2. Control Circuit Switching Relay, Nonlatching:
    a. Type: Compact general-purpose plug-in.
    b. Contact Arrangement: 3 Form C contacts.
    c. Contact Rating: 10A at 28V dc or 120V ac, and 6.6A at 240V ac.
    d. Contact Material: Silver cadmium oxide alloy.
    e. Coil Voltage: As noted or shown.
    f. Coil Power: 1.8 watts (dc), 2.7VA (ac).
    g. Expected Mechanical Life: 10,000,000 operations.
    h. Expected Electrical Life at Rated Load: 100,000 operations.
    i. Indication Type: Neon or LED indicator lamp.
    j. Push-to-test button.
    k. Manufacturer and Product: Potter and Brumfield; Series KUP.
3. Control Circuit Switching Relay, Latching:
    a. Type: Dual coil mechanical latching relay.
    b. Contact Arrangement: 2 Form C contacts.
    c. Contact Rating: 10A at 28V dc or 120V ac.
    d. Contact Material: Silver cadmium oxide alloy.
    e. Coil Voltage: As noted or shown.
    f. Coil Power: 2.7 watts (dc), 5.3VA (ac).
    g. Expected Mechanical Life: 500,000 operations.
    h. Expected Electrical Life at Rated Load: 50,000 operations.
    i. Manufacturer and Product: Potter and Brumfield; Series KB/KBP.

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4. Control Circuit Switching Relay, Time Delay:
    a. Type: Adjustable time delay relay.
    b. Contact Arrangement: 2 Form C contacts.
    c. Contact Rating: 10A at 30V dc or 277V ac.
    d. Contact Material: Silver cadmium oxide alloy.
    e. Coil Voltage: As noted or shown.
    f. Operating Temperature: Minus 10 degrees C to 55 degrees C.
    g. Repeatability: Plus or minus 2 percent.
    h. Delay Time Range: Select range such that time delay setpoint fall between 20 percent to 80 percent of range.
    i. Time Delay Setpoint: As noted or shown.
    j. Mode of Operation: As noted or shown.
    k. Adjustment Type: Integral potentiometer with knob external to dust cover.
    l. Manufacturer and Products: Potter and Brumfield; Series CB for 0.1-second to 100-minute delay time ranges, Series CK for 0.1-second to 120-second delay time ranges.

2.03 I&C COMPONENTS

A. A10 Combustible and Toxic Gas Element and Transmitter:

1. General:
    a. Function: Continuously monitor ambient air for lower explosive limit (LEL) of combustible hydrocarbon based gases. If and as noted, also monitor parts per million concentration (PPM) of additional gases.
    b. Sensor Type: Infrared, catalytic bead or electrochemical-cell unless otherwise noted.
    c. Parts: Element, transmitter, calibration kit, and ancillaries.
2. Performance:
    a. Range: 0 percent to 100 percent LEL or appropriate PPM.
    b. Repeatability: Plus or minus 2 percent of full scale.
    c. Long Term Drift (6 Months): Less than plus or minus 1 percent LEL.
    d. Response Time, t90: Less than 15 seconds.
    e. Temperature, Operating:
        1) Element/Transmitter: Minus 22 degrees F to plus 131 degrees F.
        2) Controller: 0 degree F to plus 122 degrees F.
    f. Humidity, Operating (Both Element/Transmitter and Controller): 5 percent to 95 percent relative humidity, noncondensing.

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3. Element/Sensor:
    a. Number of Sensors: One, unless otherwise noted.
    b. Gas Monitored: Combustible gas. If additional gases specified, as noted.
    c. Combustible Gas Sensor Type: Methane sensing. Infrared, unless otherwise noted.
    d. Sensor remote from transmitter, mounted at high point, unless otherwise noted.
    e. Calibration cup.
    f. If remote sensor specified:
        1) Wall mounted, mounted at high point, unless otherwise noted.
        2) Remote calibration adapter.
4. Transmitter:
    a. Number of Channels: One, unless otherwise noted.
    b. LCD display and LED alarm lights.
    c. Keypad.
    d. Audible alarm.
    e. Nonintrusive interface for functional, calibration, and alarm testing.
    f. Enclosure:
        1) Explosion proof, suitable for Class 1, Division 1, Group C and Group D; unless otherwise noted.
        2) NEMA 4X, Type 316 stainless steel.
        3) Minimum of four-wire entry holes.
        4) Mounting: Wall.
    g. Backup Battery: If noted.
5. Power: 18V dc to 30V dc, unless otherwise noted.
6. Signal Interfaces:
    a. Three SPDT relays rated for 230V ac at 5 amps resistive.
        1) Configured for warning and alarm levels, and unit fault.
    b. Analog Output: 4 mA to 20 mA dc analog output capable of driving 600 ohms at 24V dc, one signal per gas.
    c. Digital Interface: If and as noted.
7. Cables: If sensor remote from transmitter, provide cabling of required length.
8. Ancillaries:
    a. Calibration Kit:
        1) Accessories, including regulator and span cylinders of gas(es) to be monitored.
        2) For remote mount sensor, provide calibration tubing. Length as required between sensor and transmitter. Not to exceed 100 feet.

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3) Device that allows operator to non-intrusively calibrate and adjust transmitter.
4) Mounting Bracket for Transmitter and Remote Sensor: Required, unless otherwise noted.

9. Manufacturers and Products:
   a. MSA; Ultima X5000 Gas Monitor.
   b. Sensidyne Sensor; Universal Transmitter and Controller.
   c. Scott; Model 4688-IR Combustible Gas Transmitter and Sentinel Series Monitor.
   d. Draeger; Polytron XX Ex Transmitter and Controller.

B. M30 Horn, Indoor/Outdoor:

1. General:
   a. Function: Audible alarm. Produces sound by electro-mechanical vibration of a diaphragm.
2. Performance:
   a. Temperature, Operating: Minus 54 degrees F to 104 degrees F.
   b. Sound Output Level: 99 dB nominal at 10 feet (110 dB at 1 meter).
   c. Operating Current: 0.25A maximum at 120V ac.
3. Features:
   a. Dimensions: 4-3/8 inches in height and width, and 3 inches in depth, for horn and enclosure.
   b. Projector: None, unless otherwise noted.
   c. Listings: UL, UL listed.
4. Enclosure:
   a. Type: Nonmetallic polycarbonate with gasketed NEMA 4X housing. UL listed for Class 1, Division 2 area.
   b. Mounting: Surface mount. Include back box for surface mounting.
5. Power: 120V.
6. Manufacturers and Products:
   a. Federal Signal Corp.; Model 350-WBX.
   b. Edwards Signaling.

C. M31 Warning Light, Indoor/Outdoor:

1. General:
   a. Function: Visual alarm.
   b. Type: Flashing or Steady LED.
   c. Parts: Light and mounting hardware.
2. Performance:
   a. Temperature, Operating: Minus 67 degrees F to 158 degrees F.
   b. Flash Rate: Nominally 60 per minute.

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3. Features:
    a. Dome: Polycarbonate.
    b. Dome Type: Stackable segments.
    c. Number of Segments: As noted.
    d. Color and Type:
        1) One-Segment: Flashing Amber, unless otherwise noted.
        2) Two-Segment: Flashing Red and Steady Green, unless otherwise noted.
    e. Lamp Life: 50,000 hours.
    f. Lamp: LED.
4. Enclosure:
    a. Type: NEMA 4x and suitable for Class 1, Division 2.
    b. Mounting: Wall mounting bracket for vertical mount, unless otherwise noted.
    c. Listing: UL listed.
5. Power: 120V ac, 50/60-Hz.
6. Manufacturers and Products:
    a. Federal Signal; Model G-LED.
    b. Allen-Bradley; Series 855D.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 44 42 24.02
RECTANGULAR PRIMARY CLARIFIER MECHANISM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Bearing Manufacturers' Association (ABMA): 11, Load Ratings and Fatigue Life for Roller Bearings.
2. American Gear Manufacturers Association (AGMA).
3. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A48/A48M, Standard Specification for Gray Iron Castings.
   c. D570, Standard Test Method for Water Absorption in Plastics.
   d. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
4. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. MG 1, Motors and Generators.
5. UL: 674, L Standard for Safety Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Make, model, weight, and horsepower of each equipment assembly.
   b. Manufacturer's catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Motor data in accordance with Section 26 05 01, Electrical.
   d. Detailed structural, mechanical, and electrical drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of equipment associated therewith.
   e. Manufacturer's recommended storage maintenance and maintenance log.
   f. Chain load capacities.
   g. Method of tightening drive chain.

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h. Complete design calculations of chain pull requirements for a dry basin.
i. Outside utility requirements such as air, water, power, drain, for each component.
j. ACA4-square test report for chain type submitted.
k. Power wiring diagrams, including terminals and numbers.
l. Painting Systems: Include manufacturer's descriptive technical catalog literature and specifications.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.
2. Completed maintenance logs as maintenance is performed.
3. Proof of manufacturer's acceptance of concrete tank tolerances.
4. Special shipping, storage and protection, and handling instructions.
5. Laboratory test results, reports, and certifications.
   a. Include: Proof load test and collector chain test.
6. Anchorage and bracing calculations in accordance with Section 01 88 15, Anchorage and Bracing.
7. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.
8. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

1.03 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

Item	Quantity
Special tools required to maintain or dismantle	1 complete set
10-foot strand of nonmetallic flight chain with F-22-8 attachments	4
Strand of drive chain sufficient to drive one collector	2
Shear pins	12
Fiberglass flights	3
Floor wear shoes	20
Return wear shoes	20

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B. Provide scheduled quantity of spare parts for cross collectors and longitudinal collectors.

C. Delivery: In accordance with Section 01 61 00, Common Product Requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. The mechanisms will be installed in refinished concrete primary clarifier basins. Contractor shall coordinate final finished basin dimensions and mechanism installation tolerances with equipment manufacturer's approved Shop Drawings. All mechanisms provided shall be identical.

B. Contractor shall coordinate storage and maintenance requirements with the equipment manufacturer.

C. Contractor to coordinate storage locations with Owner.

2.02 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Brentwood/Polychem Systems.
2. Evoqua.

B. "Or-equal" products will be considered.

2.03 MANUFACTURED UNITS

A. Six chain-and-flight longitudinal collectors, six chain-and-flight cross collectors, and six helical scum skimmers mechanisms.

B. Collect and convey primary sludge to basin sludge hoppers and to provide surface scum skimming to collect primary scum.

C. Longitudinal Collector Flights:

1. Linear speed of approximately 1 fpm.
2. Capable of moving primary sludge with a dry solids concentration of 5 percent and skimming scum with a concentration of 0.5 percent dry solids.

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2.04 LONGITUDINAL COLLECTORS

A. Suitable for installation in six rectangular clarifier basins 20 feet wide by 125 feet long with a maximum sidewater depth of 12.25 feet and a sludge hopper 5 feet wide by 20 feet long with a maximum depth of 18.75 feet. See Drawings. Coordinate final basin dimensions and equipment installation tolerances.

B. Four-shaft longitudinal sludge/scum collectors and three-shaft sludge cross collectors in each basin.

C. Collect sludge at the influent end of the basins. Move scum to a collection area at discharge end of basins.

D. Drive each collector by single electric motor and reducer.

E. Shafts:

1. Longitudinal collector headshaft of each unit:
   a. Manufacturer standard three-piece overlapping FRP tubes OR cold-finished carbon steel head shaft spanning clarifier basin.
   b. Two nonmetallic keyed sprockets that drive two parallel endless strands of nonmetallic chain. Chains shall pass over additional sets of sprockets, defined herein.
2. Idler Shafts: Manufacturer standard cast nylon-6 stub shaft OR cast ductile iron base with stainless steel stub shaft.
3. Cross Collector Headshaft: Manufacturer standard single FRP tube OR carbon steel solid shaft.

2.05 SCRAPER FLIGHTS

A. Span compartment width and scrape settled sludge from the basin bottom. Designed to convey sludge to sludge hopper and convey scum to scum collection area by nonmetallic chain.

B. Reinforced fiberglass, minimum 45 percent glass by weight with maximum 0.6 percent water absorption at 24-hour exposure at 73 degrees F conforming to ASTM D570.

C. Continuous fiberglass filaments in addition to fiberglass mat running full length of member.

D. Nominal Size: 3 inches by 8 inches, designed for sludge collection.

E. Scraper Lip: On leading edge to ensure clean basin floor.

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F. Polypropylene or Synthetic Filler Blocks: For bolting member to chain attachment links.

G. Drilled and notched.

H. Attachment Hardware: Type 316 stainless steel.

I. Spacing: Maximum 10 feet on center on two strands of flight chain.

J. Maximum Deflection:

1. Horizontal: 1-inch maximum deflection at mid span when subjected to a uniform load of 4 pounds per linear foot.
2. Vertical: 0.021 inch per foot while simply supported on wear shoes.

K. Buoyant flight design will not be acceptable.

L. Manufacturer to provide correct radius dimension to allow contractor to ensure proper flight clearance when rotated around tail shaft Flight shall have an end clearance of 1 inch to basin walls.

2.06 FLIGHT CHAINS

A. NCS720-S non-metallic glass reinforced polyester or unfilled acetal resin, integral ultraviolet radiation protected, corrosion resistant and abrasion resistant to contaminants and abrasives that are normally found in primary sedimentation applications.

B. Minimum weight of 1.3 pounds per foot and maximum longitudinal elongation of 1.5 percent at minimum working load.

C. Minimum Working Load: 3,100 pounds per strand.

D. Chain Links: 6-inch pitch, integrally molded with barrel and both side bars formed in one piece.

E. Chain Pins:

1. One-piece, T-head construction featuring reinforced nylon encapsulated in acetal resin.
2. Capable of locking inside molded chain link without use of pin locks or cotters.
3. Split type pins will not be accepted.

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2.07 DRIVE CHAINS

A. Nonmetallic Type: NH-78 reinforced nylon resin or unfilled acetal resin with stainless steel pins.

1. Links: 2.609-inch pitch.
2. Minimum Working Load: 1,740 pounds.
3. Weight: 1.17 pounds per foot, minimum.
4. Drive chain arrangement shall include a chain tightener to take up excessive slack in the drive chain. The tightener assembly shall include a Cast Nylon 6 slide arm and an FRP mounting bracket anchored to the top of the deck. The idler sprocket shall be reinforced Nylon 6-6 and have 7 teeth, or the tightener assembly shall include a stainless steel slide base and mounting bracket with a self-lubricated molded polyurethane idler sprocket.

B. Stainless Steel Type:

1. Links: 2.609-inch pitch.
2. Average Weight: 3.9 pounds per foot.
3. Components: 400 series stainless steel, through-hardened.
4. Rated Working Load: 3,300 pounds and ultimate strength of 24,000 pounds, minimum.

2.08 CHAIN SPROCKETS

A. Collector Chain Head and Idler Shaft Sprockets:

1. Compatible with chain material and chain rim saver type.
2. Split construction to facilitate installation to be secured together on shafting with Type 316 stainless steel through bolt hardware.
3. Idler sprockets shall be solid one-piece construction for ease of installation on to stub shafts.
4. Reversible to use wearing surfaces on both faces of sprocket teeth.
5. Cast Nylon-6, or Polyurethane with Pitch of 1/2 of Chain Pitch:
   a. Cast Nylon: Rockwell hardness of R115 when measured at the time of manufacture.
   b. Polyurethane: Hardness of not less than 80 Shore “D” in accordance with ASTM D2240 and a water absorption rate not to exceed 1.3 percent saturation in accordance with ASTM D570.
6. Head shaft sprockets 22-inch pitch diameter, minimum and a minimum of 23 teeth.

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7. Idler stub shaft sprockets shall have a minimum of 17 teeth and a nominal pitch diameter of 16.61 inches.
8. All sprockets to be the same diameter and the chain saver radius shall match the inside radius of the chain link side bar.

B. Chain Driving Sprocket: Keyed with setscrew for attachment to gear shaft.

1. Each Sprocket: Split type construction.
2. Driven "Bull" Sprocket:
   a. Split construction to facilitate installation.
   b. Key Sprockets: Keyed with setscrews for attachment to the head shaft, of offset type.
   c. Driven sprockets shall be molded from cast nylon hub with integral teeth. A polyurethane hub and easily replaceable Cast Nylon 6 or polyurethane teeth are acceptable.

C. Take-up Sprocket: Self-lubricated molded polyurethane or solid nylon construction. Bracket assembly shall also be of cast nylon or 316 stainless steel.

D. Sprocket Teeth:

1. Machine so link barrels will bear simultaneously and evenly against teeth.
2. Uneven number so that wear on sprocket is reduced by one half.

E. Hardware: Type 316 stainless steel.

F. If carbon steel shafting is used, idler sprockets may be of split type construction.

2.09 FLIGHT WEARING SHOES

A. Located where flights come in contact with bottom rails on concrete floor and where flights come in contact with wear strips attached to return tracks.

B. 1/2-inch-thick minimum lubricated Nylon 6-6 or UHMW-PE with minimum hardness of 80/85 Shore "A".

C. Bolt-on type and firmly bolted to the flights.

D. Reversible to provide two wearing surfaces.

E. Design to run on floor rails and on return track rails.

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2.10 FLIGHT ATTACHMENTS

A. Same material and strength as flight chains. Extend attachment full depth of flight and fasten to flights with four Type 316 stainless steel bolts, minimum diameter 3/8 inch, complete with nuts and lock washers.

2.11 BEARINGS

A. Submerged: Internal one-piece slip fitting UHMWPE tubular bearings, machined with keyways or Type 316 cast stainless steel per ASTM A351 Grade CF8M, self-aligning type, having a molded polyurethane hub ball.

1. Water lubricated while in operation.
2. Affix submerged bearings to head shaft spindle with nonmetallic key.
3. Where stub shaft bearings are used in conjunction with tubular shafting, bearing outside diameter shall slide fit to inside diameter of nonmetallic telescope drive shaft assembly.
4. Where stub shaft bearings are used in conjunction with idler sprockets, stub shaft spindle shall have cast nylon retainer plate mounted with one 1-inch-diameter, 8 threads per inch, 3-inch-long hex head bolt, flat washer, and split lock washer, of Type 316 stainless steel.

B. Take-up Bearings:

1. Take-up Bearings shall not be allowed.
2. In lieu of Take-Up Bearings manufacturer shall supply “Half links” for each collector chain strand. Spray paint partial length chain link orange for easy identification.

2.12 WALL BRACKET ASSEMBLY

A. Wall Bracket: Solid type shall be molded of glass reinforced Nylon 6-6, or Type 304 stainless steel, minimum 3/8-inch construction.

B. Predrilled rail to provide mounting holes for attachment to walls and for attachment of run shoe and return rail.

C. Run Shoe: Nominal 1/2-inch-thick Nylon 6-6 or UHMWPE material and predrilled for attaching to wall bracket and mounting of the return rail.

D. Hardware: Type 316 stainless steel. Anchors shall be minimum 3/4-inch diameter.

E. Double bolted to wall to prevent movement after alignment is achieved.

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2.13 RETURN RAILS

Fiberglass reinforced plastic measuring 3 inches by 3 inches by 3/8 inch thick with angles at 90-degree planes supported at approximately every 10 feet.

A. Attachment Hardware: Type 316 stainless steel. Bolts minimum 3/8-inch diameter.

B. Cut, drill, and fit in field for installation. Supply in lengths of 20 feet or multiples of 20 feet.

2.14 WEAR STRIPS

A. UHMW polyethylene, minimum 3/8 inch thick.

B. Attach floor wear strips to basin floor with No. 14 by 1-1/4-inch long sheet metal screw minimum, with suitable nonmetallic anchor.

C. Attach return rail wear strip to return rail with bolts minimum 3/8-inch diameter.

D. Attachment Hardware: Type 316 stainless steel.

E. Mounted such that thermal expansion does not prevent wear shoes from contacting wear strips. Leveled after placement such that flight wearing shoes travel evenly on wear strips and return rails when installed.

2.15 STUB SHAFT SPINDLE AND CROSS SHAFT

A. Stub Shaft Spindle: Cast Nylon-6 idler shaft predrilled for mounting. Type 304 stainless steel idler shaft with cast iron base also acceptable.

1. Hardware: Type 316 stainless steel with wall studs of 1-inch minimum diameter.

2.16 HEAD SHAFT ASSEMBLY

A. Main Longitudinal Drive Shafts:

1. Three-piece, overlapping, fiberglass tubes, or solid cold-finished carbon steel.
   a. Factory prime carbon steal shaft.
2. Drive Shaft Inside Diameter: Tubular bearing, solid type construction of cast nylon material.
3. Hardware: Type 316 stainless steel.
4. Keyway and key required to fit nonmetallic drive sprockets.

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2.17 DRIVE UNITS

A. Electric motor, torque switch, reducers, jaw clutches, drive base, drive chains, sprockets, and chain guards.

B. Drive for One Longitudinal Collector:

1. Shaft Design: Right angle, single output, with reducer suitable for mounting on a concrete base. Required recesses, corbels, and corner fill as determined by the manufacturer.
2. Motor: Directly connected to the speed reducer. V-belt drives will not be acceptable.
3. Drive Unit Speed Reducer: Worm-gear or helical gear type, fully housed, running in oil, with antifriction bearing throughout.
4. Drive Unit Bearings: ABMA L-10, minimum 100,000-hour bearing life.
5. Meet AGMA Standards for moderate shock, 24-hour continuous service.
6. Rating Plate: Attached to each unit showing AGMA rating.
7. Service Factor: 1.25 minimum.

C. Drive for One Cross Collector:

1. Shaft Design: Right angle, single output, suitable for mounting on concrete base. Required recesses, corbels, and corner fill as determined by the manufacturer.
2. Motor: Directly connected to speed reducer. V-belt drives will not be acceptable.
3. Drive Unit Speed Reducer: Helical bevel gear or worm-gear type, fully housed, minimum 95 percent efficient, running in oil, with antifriction bearing throughout.
4. Drive Unit Bearings: ABMA L-10, minimum 100,000-hour bearing life.
5. Meet AGMA Standards for moderate shock, 24-hour service.
6. Rating Plate: Attached to each unit showing AGMA rating.

D. Drive Motors: See the Induction Motor Data Sheets at end of section.

2.18 GUARDS AND LOAD LIMITING DEVICES

A. Provide drive sprocket with shear pin and limit switch to provide for full protection of equipment in case of excessive loading.

1. Drive sprocket assemblies shall be designed to protect the drive equipment and be furnished with a suitably sized aluminum necked down shear pin to transmit torque from the driving hub to the sprocket.

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2. In the event of a high load or over torque condition, the shear pin shall break and disengage the drive sprocket from the hub.
3. The drive sprocket hub shall be equipped with a trip pin or lug that, upon breaking the shear pin, shall extend out from the hub and contact a limit switch actuator arm, which shall signal the shut down the motor and an alarm circuit.

B. Limit Switches:

1. Mount in a NEMA 250, Type 4X, enclosure.
2. Include one single-pole double-throw contacts two normally open and two normally closed rated 10 amps continuous at 120 volts, 60-Hz.
3. Actuates upon failure of the shear pin for cutout and alarm.
4. The limit switch shall be provided with a support bracket for positioning the limit switch adjacent to the torque device.

C. Removable sheet metal guards of not less than 12-gauge Type 316 stainless steel to enclose moving parts above basin top slab.

2.19 PRIMARY SLUDGE CROSS COLLECTOR

A. Chain and flight type.

B. Located at bottom of primary sludge hoppers at the influent end of primary clarifiers. Discharge into smaller hopper located at end of primary sludge hopper.

C. Conveyor:

1. Transport primary sludge with 3 percent to 5 percent dry solids content.
2. Operate at a linear speed of 4 feet per minute.
3. Sludge Loading: 4.5 pounds per foot at 5 percent solids concentration.

D. Components to match the longitudinal collectors components.

2.20 HELICAL SCUM SKIMMER

A. Structural Steel: ASTM A36/A36M.

B. Iron Castings: ASTM A48/A48M.

C. Helical Reel Assembly Unit:

1. Helical Reel Material: 1018 CRS
2. 3/8-inch-thick neoprene or synthetic rubber strip bolted to 3/16-inch steel spiral blade by use of 1-1/4-inch by 3/16-inch steel clamp bar.

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3. Spiral Blade Support: 3/4-inch steel arms welded to 5-inch-diameter Schedule 80 steel pipe provided with 5/8-inch-thick steel flanges, welded perpendicularly to centerline of pipe.
4. Make spiral on blade symmetrical about centerline of reel.
5. Diameter: 36-inch.

D. Reel Shaft:

1. Steel, sized to transmit power required.
2. Keyways with fitted keys.
3. Collars securely attached to shaft by setscrews where necessary to keep sprockets in proper alignment.
4. Key steel flanged couplings to shafting for fastening to reel.

E. Bearing Assembly:

1. Self-aligning type, with a UHMW-PE insert or self-aligning type with cast iron housing.
2. Provided extended lubrication lines to make lubrication points accessible at walkway.

F. Drive Chain:

1. Nonmetallic Type: Reinforced nylon resin with stainless steel pins.
2. High carbon steel, heat treated, conforming to ASTM A36/A36M Class 2.
    a. Roller chain type with case hardened pins and bushings.
    b. Slush drive chains in heavy oil before shipment.

G. Sprockets:

1. Cast iron conforming to ASTM A48/A48M, Class 40, or cast nylon.
2. Teeth: Properly formed to mesh accurately with chain.
3. Key sprockets to the shafts.

H. Beach Plate:

1. 1/4-inch Type 304 stainless steel forming an inclined beach having radius so neoprene blade cannot be jammed.
2. Vertical sections to fasten to end wall of trough and form watertight seal.
3. Beach plate wall plates to be coordinate with existing basin and scum trough dimensions.
4. Overhang concrete scum channel to prevent scum accumulation on channel wall.

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I. Drive Unit: Electric motor and worm or helical bevel gear reducer.

1. Gear Reducer: Equip with antifriction bearing with bearing life of 25,000 hours, minimum.
   a. Gears: Steel, cut to accurate form and encased in a heavy moisture- and oil-proof case.
2. Motor: See Induction Motor Data Sheet at end of this section.

2.21 DISSIMILAR METALS

A. Isolate dissimilar metals or connectors to prevent direct contact and electrical conductivity.

1. Use 1/8-inch thick continuous neoprene gasket to insulate aluminum gratings, checker plate and handrail post bases from access walkway supports, and other components.
2. Use insulating washers and sleeves, as defined in Section 40 27 00, Process Piping – General, at bolted connections.

2.22 ACCESSORIES

A. Radius Screed: Finish grout-filled curved end of basin.

2.23 APPURTENANCES

A. Lifting Lugs: Suitably attached for equipment assemblies and components weighing over 100 pounds.

B. Equipment Identification Plates: 16-gauge Type 316 stainless steel identification plate securely mounted on each separate drive unit assembly in a readily visible location. Plate shall bear 3/8-inch high engraved block type black enamel filled equipment identification number indicated in this Specification and as shown.

2.24 FABRICATION

A. Shop fabricate and assemble mechanism components in largest sections practicable and permitted by transportation carrier regulations.

B. Anchorage:

1. Type 316 stainless steel, sized by equipment manufacturer in accordance with Section 01 88 15, Anchorage and Bracing.
2. Minimum Diameter: 1/2-inch.

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C. Shop/Factory Finishing:

1. Primer, stripe coat, and finish coating to be applied in factory and touch-up coating to be applied in field.
2. Paint submerged ferrous metal in accordance with Section 09 90 00, Painting and Coating, System No. 2, blast clean with two coats of high-build epoxy, suitable for wastewater applications. Surfaces inaccessible subsequent to erection shall be prepared, primed, and finished with the applicable coating system prior to erection. Any shop-applied and field-applied coatings shall be by same manufacturer to ensure compatibility.
3. Paint nonsubmerged fabricated steel components in accordance with Section 09 90 00, Painting and Coating, System No. 4. Surfaces inaccessible subsequent to erection shall be prepared, primed, and finished with the applicable coating prior to erection. Any shop-applied and field-applied coatings shall be by same manufacturer to ensure compatibility.
4. Seal welding shall be provided for submerged welded joints. Skip welds are not acceptable (e.g. back to back angles shall be seal welded on both ends/edges of mating surface).
5. Exposed metal surfaces of motors, gear reducers, and assemblies shall be factory prepared and primed coated in accordance with manufacturer's premium epoxy coating system for wastewater service, and finish coated with a Polyurethane Enamel per System No. 4 in accordance with Section 09 90 00, Painting and Coating. Provide tie-coat between shop primer and field finish in accordance with field coating manufacturer's recommendations.
6. Exposed metal surfaces of carbon steel head shafts for longitudinal and cross collectors shall be factory prepared, primed, and field finish coated in accordance with manufacturer's premium epoxy coating system for wastewater service and meeting the requirements of Section 09 90 00, Painting and Coating, System No. 2.

2.25 SOURCE QUALITY CONTROL

A. Factory Inspections: Inspect control panels for required construction, electrical connection, and intended function.

B. Laboratory Tests:

1. Test identical to equipment furnished.
2. Proof Load Tests:
   a. Conducted by independent testing laboratory.

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b. Load test minimum of one six-pitch strand or flight attachment links randomly selected from chain supplied to the Site. Load each strand to 5,000 pounds to ensure proper molding and link design. Chains shall be unaffected by the proof loading.
c. Cost of independent laboratory testing shall be borne by Contractor.

PART 3 EXECUTION

3.01 STORAGE

A. Store sludge collector and scum skimmer mechanism components in Owner provided areas, as shown on Drawings.

B. Maintain equipment according to manufacturer's required maintenance.

1. Maintain a maintenance log of all maintenance performed. Log maintenance performed immediately and submit the updated log within 24 hours of maintenance.

3.02 PREPARATION

A. Contractor to coordinate final basin dimensions and tolerances with manufacturer.

B. Level basin floors and wall straightness to within tolerances required by equipment manufacturer, which may exceed the concrete tolerance in Section 03 01 33, Repair of Horizontal Concrete Surfaces. The manufacturer's tolerance requirements shall govern if they are more stringent than specified concrete tolerances.

C. In accordance with manufacturer's written instructions.

D. Radius Screed: Finish grout-filled curved end of basin.

E. Offset wear strip joints by 5 feet so flights do not make contract with all joints at the same time.

F. Following completion of the concrete installation, measure resulting tolerances to confirm compliance with manufacturer's requirements. Manufacturer shall accept actual concrete tank tolerances in writing prior to equipment installation.

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G. Clarifier mechanism shall be run dry, with wear strips lubricated for at least one complete revolution to clear wall and floor. Flights shall have between 1/2-inch and 1-inch wall clearance and shall have between 3/8-inch and 3/4-inch floor clearance. Concrete shall be ground to achieve these clearances.

H. Drive loading running wet shall be a maximum of 50 percent of the dry running loading.

I. Units shall be run a minimum of 7 days in a wet condition without problems prior to introduction of raw sewage into the basin.

3.03 INSTALLATION

A. In accordance with manufacturer's written instructions.

B. Level scum skimmer to plus or minus 1/8 inch of design elevation.

C. Accurately place anchor bolts using templates furnished by manufacturer and in accordance with Section 05 05 19, Post-Installed Anchors.

D. No field welding, except seal welding to provide specific degree of tightness against leakage, will be allowed.

3.04 FIELD FINISHING

A. Paint immersed ferrous metal that is not shop painted or that is damaged during shipping, handling, and installation in accordance with Section 09 90 00, Painting and Coating, System No. 2, blast clean with two coats of high-build epoxy, suitable for wastewater applications. Any shop-applied and field-applied coatings shall be by same manufacturer to ensure compatibility.

1. Field finish carbon steel headshaft, if provided by manufacturer.

B. Paint nonsubmerged ferrous metal that is not shop painted or that is damaged during shipping, handling, and installation in accordance with Section 09 90 00, Painting and Coating, System No. 4. Any shop-applied and field-applied coatings shall be by same manufacturer to ensure compatibility.

C. Exposed metal surfaces of motors, gear reducers, and assemblies shall be factory prepared and prime coated in accordance with manufacturer's premium epoxy coating system for wastewater service, and finish coated with a Polyurethane Enamel per System No. 4 in accordance with Section 09 90 00, Painting and Coating. Provide tie-coat between shop primer

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and field finish in accordance with field coating manufacturer's recommendations.

D. Exposed metal surfaces of carbon steel head shafts for longitudinal and cross collectors shall be prepared, primed, and finish coated in accordance with manufacturer's premium epoxy coating system for wastewater service and meeting the requirements of Section 09 90 00, Painting and Coating, System No. 2.

E. Holiday test after installation and touch up damaged shop coatings in accordance with Section 09 90 00, Painting and Coating.

F. Touch up paint exposed metal surfaces of motors, gear reducers, and assemblies in accordance with Section 09 90 00, Painting and Coating.

3.05 FIELD QUALITY CONTROL

A. Inspection:

1. Prior to placement of clarifiers into service, check weir plate elevations by filling clarifiers with water to elevation shown.
2. Level weirs to within plus or minus 1/8 inch of design elevations.

B. Functional Tests: Conduct on each mechanism, drive unit assembly, and sludge collector pipe.

C. Performance Test: Confirm mechanical, electrical, and structural compliance with specified torque requirements.

1. Load each mechanism with alarm and cutout (shutdown) torques.
2. Test with machine in operation.
3. Demonstrate mechanism overload devices; verify actual torques at which alarm and cutout (shutdown) contacts and load limiting device are actuated. Correlate with scale indications.
4. Test all clarifier mechanism(s) of this group.
5. Demonstrate that all motors operate within power input criteria specified herein.

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3.06 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: Present at Site or classroom designated by Owner for minimum person-days listed below, travel time excluded.

1. Chain and Flight Equipment:
   a. 3 person-days for installation assistance, inspection, and certification of installation. (1 person-day per two mechanisms).
   b. 3 person-days for functional testing. (1 person-day per two mechanisms).
   c. 3 person-days for training of Owner's personnel. (1 person-day per two mechanisms).
2. Scum Collector:
   a. 3 person-days for installation assistance, inspection, and certification of installation. (1 person-day per two mechanisms).
   b. 3 person-days for functional testing. (1 person-day per two mechanisms).
   c. 3 person-days for training of Owner's personnel. (1 person-day per two mechanisms).

B. See Section 01 43 33, Manufacturers' Field Services, and Section 01 91 14, Equipment Testing and Facility Startup.

3.07 SUPPLEMENTS

A. Supplements listed below, following "End of Section," are a part of this Specification.

1. Longitudinal Sludge Collectors 1-6 Induction Motor Data Sheet.
2. Cross Collectors 1-6 Induction Motor Data Sheet.
3. Scum Collectors 1-6 Induction Motor Data Sheet.

END OF SECTION

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LONGITUDINAL SLUDGE COLLECTORS 1-6
INDUCTION MOTOR DATA SHEET

Project: Tri-City Primary Clarifier Rehab

Owner: Clackamas County Water Environment Services

Equipment Name: Longitudinal Sludge Collectors 1-6

Equipment Tag Number(s): 210-COL-2111A thru 210-COL-2116A

Type: Squirrel-cage induction meeting requirements of NEMA MG 1

Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.

Hazardous Location: ☒ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Horsepower: 0.5 hp

Voltage: 460V

Phase: 3

Frequency: 60 Hz

Synchronous Speed: 1,800 rpm

☐ Thermal Protection: _____

☐ Space Heater: ____ volts, single-phase

Guaranteed Minimum Efficiency at Full Load: ____ percent

Guaranteed Minimum Power Factor at Full Load: ____ percent

Service Factor (@ rated max. amb. temp.): ☐ 1.0 ☒ 1.25

Enclosure Type: TEFC

☐ Multispeed, Two-Speed: ____ / ____ rpm

Winding: ☐ One ☐ Two

Mounting Type: ☐ Horizontal ☒ Vertical

☐ Vertical Shaft: ☐ Solid ☐ Hollow

☐ Vertical Thrust Capacity (lb): Up ____ Down ____

Operating Speed Range: ____ to ____% of Rated Speed

☐ Variable Torque

☐ Constant Torque

Additional Motor Requirements: ☒ See Section 26 05 01, Electrical.

Special Features:

Motor to be rated for Class 1 Division II Group D area.

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CROSS COLLECTORS 1-6
INDUCTION MOTOR DATA SHEET

Project: Tri-City Primary Clarifier Rehab

Owner: Clackamas County Water Environment Services

Equipment Name: Cross Collector 1-6

Equipment Tag Number(s): 210-COL-2111B thru 210-COL-2116B

Type: Squirrel-cage induction meeting requirements of NEMA MG 1

Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.

Hazardous Location: ☒ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Horsepower: 0.5 hp

Voltage: 460 V

Phase: 3

Frequency: 60-Hz

Synchronous Speed: 1,800 rpm

☐ Thermal Protection: _____

☐ Space Heater: ____ volts, single-phase

Guaranteed Minimum Efficiency at Full Load: ____ percent

Guaranteed Minimum Power Factor at Full Load: ____ percent

Service Factor (@ rated max. amb. temp.): ☐ 1.0 ☒ 1.25

Enclosure Type: TEFC

☐ Multispeed, Two-Speed: ____ / ____ rpm

Winding: ☐ One ☐ Two

Mounting Type: ☐ Horizontal ☒ Vertical

☐ Vertical Shaft: ☐ Solid ☐ Hollow

☐ Vertical Thrust Capacity (lb): Up ____ Down ____

Operating Speed Range: ____ to ____% of Rated Speed

☐ Variable Torque

☐ Constant Torque

Additional Motor Requirements: ☒ See Section 26 05 01, Electrical.

Special Features:

Motor to be rated for Class 1 Division II Group D area.

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SCUM COLLECTORS 1-6
INDUCTION MOTOR DATA SHEET

Project: Tri-City Primary Clarifier Rehab

Owner: Clackamas County Water Environment Services

Equipment Name: Scum Collectors 1-6

Equipment Tag Number(s): 210-SKM-2131 thru 210-SKM-2136

Type: Squirrel-cage induction meeting requirements of NEMA MG 1

Manufacturer: For multiple units of the same type of equipment, furnish motors and accessories of a single manufacturer.

Hazardous Location: ☒ Furnish motors for hazardous (classified) locations that conform to UL 674 and have an applied UL listing mark.

Motor Horsepower: 0.5 hp

Voltage: 460 V

Phase: 3

Frequency: 60-Hz

Synchronous Speed: 1,800 rpm

☐ Thermal Protection: _____

☐ Space Heater: ____ volts, single-phase

Guaranteed Minimum Efficiency at Full Load: ____ percent

Guaranteed Minimum Power Factor at Full Load: ____ percent

Service Factor (@ rated max. amb. temp.): ☐ 1.0 ☒ 1.15

Enclosure Type: TEFC

☐ Multispeed, Two-Speed: ____ / ____ rpm

Winding: ☐ One ☐ Two

Mounting Type: ☐ Horizontal ☒ Vertical

☐ Vertical Shaft: ☐ Solid ☐ Hollow

☐ Vertical Thrust Capacity (lb): Up ____ Down ____

Operating Speed Range: ____ to ____% of Rated Speed

☐ Variable Torque

☐ Constant Torque

Additional Motor Requirements: ☒ See Section 26 05 01, Electrical.

Special Features:

Motor to be rated for Class 1 Division II Group D area.

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SECTION 44 42 24.03
FIBERGLASS REINFORCED PLASTIC EFFLUENT LAUNDERS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A48/A48M, Standard Specification for Gray Iron Castings.
   c. D570, Standard Test Method for Water Absorption in Plastics.
   d. D695, Compressive Properties of Rigid Plastics.
   e. D696, Coefficient of Linear Expansion.
   f. D790, Flexural Properties.
   g. D1056, Polymer Grade.
   h. D2240, Standard Test Method for Rubber Property-Durometer Hardness.
   i. D2563, Visual Defects.
   j. D2583 Indentation Hardness.
   k. D2584, Resin Glass, and Filler Contents.

1.02 DEFINITIONS

A. FRP: Fiberglass reinforced plastic.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Make, model, and weight of each equipment assembly.
   b. Manufacturer’s catalog information, descriptive literature, specifications, and identification of materials of construction.
   c. Detailed Structural and Mechanical Drawings showing the equipment fabrications and interface with other items. Include dimensions, size, and locations of connections to other work, and weights of associated equipment associated therewith.

B. Informational Submittals:

1. Manufacturer’s Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.

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2. Special shipping, storage and protection, and handling instructions.
3. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.
4. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL

A. Effluent launders to match existing launders as shown on Drawings.

2.02 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. Brentwood/Polychem Systems.
2. Miles Fiberglass and Composites, Inc.

2.03 EFFLUENT LAUNDERS AND SUPPORTS

A. V-Notch Launders: Dimensions and support as shown on Drawings.

B. Materials: Fiberglass.

1. Match-Die Molded Fiberglass: 1/4-inch minimum thickness, in accordance with AWWA F102.
2. Resin: Except as modified by this specification, conform to ASTM C581.
   a. Type II: Suitable for intended service; premium grade and corrosion-resistant such as chlorendic polyester, vinyl ester, or bisphenol A fumarate polyester.
   b. Shall not contain fillers or thixotropic agents, except as may be required, and shall conform to resin manufacturer's recommendations.
      1) Glass Content: 20 percent to 30 percent.
      2) Inorganic Fillers: No less than 40 percent of resin mixture.
   c. Coloring: Pigmented gel-coat containing ultra-violet blocking agent; manufacturer's standard color.
   d. Sufficient thixotropic agents to form a paste to seal machined or cut edges.

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e. Reinforcement:
   1) Commercial grade glass, made specifically for use in fiberglass reinforced plastic, and having a coupling agent providing a compatible bond between the glass reinforcement and the resin.
   2) Weight and density may be varied to obtain necessary resin-glass ratio and structural strength for the specified service.

f. Mold Surfaces: Reinforced with surfacing mat, followed by minimum of 3 ounces of chopped strand mat, in a minimum of two layers, with no other product introduced between layers.

g. Exposed Surfaces:
   1) Resin-rich, 10 mils to 20-mils thick with Type C surfacing mat, silane finish, and styrene-soluble binder.
   2) Glass fibers shall not be exposed.
   3) Chopped strand and chopped strand mat shall be Type E glass with silane finish and styrene-soluble binder.
   4) Minimum Glass Content: 30 percent by weight.

h. Laminates:

Property (70 Degrees F)	**ASTM Standard**	**Value**
Ultimate Tensile Strength, psi	D638	7,500 minimum
Flexural Strength, psi	D790	16,000 minimum
Flexural Modulus, psi	D790	800,000 minimum
Water Absorption	D570	0.2% in 24 hours
Impact, foot-pounds	D256	10

i. Barcoal Hardness: ASTM D2583; minimum 90 percent of resin manufacturer's minimum specified hardness for cured, nonreinforced resin.

j. Allowable Cosmetic Defects: As defined in AWWA F102.

k. Final Laminate:
   1) Thickness: Within plus or minus 10 percent of nominal laminate thickness.
   2) Tolerance: Plus 1/16 inch; minus 0 inch of minimum specified thickness.
   3) Void Content (Completed Laminate): Maximum 2-1/2 percent of laminate by volume.

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C. Manufacturers: Manufacturers shall have 10 years' experience in design and manufacture of FRP structures.

1. Brentwood/Polychem Systems.
2. Miles Fiberglass and Composites, Inc.

PART 3 EXECUTION

3.01 STORAGE

A. FRP launders shall be protected from the sun and weather before installation, following manufacturers recommended storage instructions.

3.02 INSTALLATION

A. Contractor to coordinate final basin dimensions and tolerances with manufacturer.

B. Following completion of the concrete installation, measure resulting tolerances to confirm compliance with manufacturer's requirements.

3.03 FIELD QUALITY CONTROL

A. Inspection:

1. Prior to placement of clarifiers into service, check weir plate elevations by filling clarifiers with water to elevation shown.
2. Level weirs to within plus or minus 1/8 inch of design elevations.

B. Functional Tests: Conduct on each launder. Fill with water and verify no leaks are present.

END OF SECTION

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CLACKAMAS
WATER ENVIRONMENT SERVICES

OREGON CITY, OREGON

CONTRACT DOCUMENTS

for the construction of the

TRI-CITY WRRF PRIMARY CLARIFIER REHABILITATION

WES Project No. P632324

****

****

JACOBS

Corvallis, Oregon

June 2022

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EXHIBIT F

Drawings

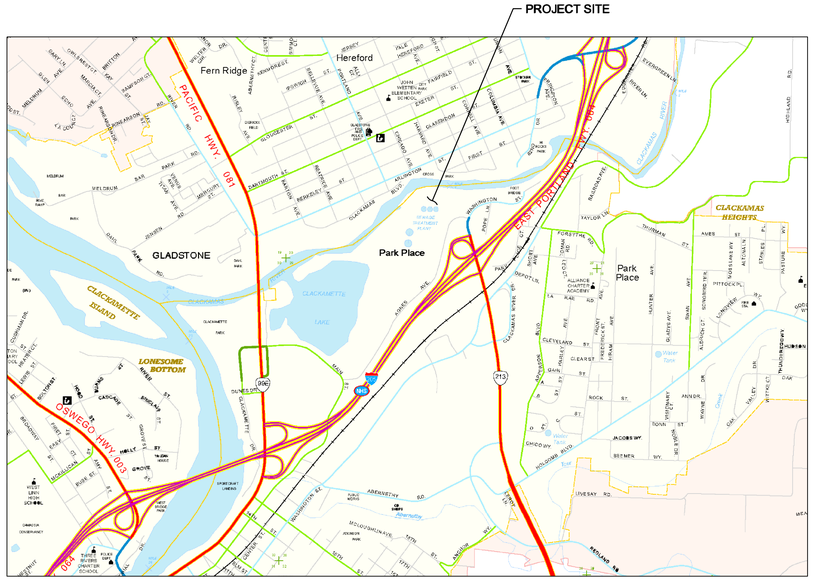
TRI-CITY WRRF
PRIMARY CLARIFIER REHABILITATION
WATER ENVIRONMENT SERVICES
CLACKAMAS COUNTY

OREGON CITY, OREGON

100% CONTRACT DOCUMENTS
JUNE 2022
WES PROJECT No.: P632324

N

VICINITY MAP



N

LOCATION MAP

REGISTERED PROFESSIONAL ENGINEER
7360TPE
Digital Signature
OREGON
JANUARY 11, 2005
TODD WILSON DYE
EXP. 12-31-23

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		T DYE	S BRENNWALD	T DYE	B FULLER		

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

GENERAL
COVER SHEET, LOCATION, AND VICINITY MAPS

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-1
SHEET	1 of 45

Sheet No.	Drawing No.	Drawing Title
		10 - GENERAL SHEETS
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4	10-G-4	ABBREVIATIONS - 2
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7	10-G-7	INSTRUMENTATION AND CONTROL LEGEND - 2
8	10-G-8	ARCHITECTURAL GENERAL NOTES, MATERIAL SYMBOLS, LEGEND, LIFE SAFETY PLAN SCHEDULES
9	10-G-9	PROCESS MECHANICAL LEGEND
10	10-G-10	HVAC AND PLUMBING LEGEND
11	10-G-11	ELECTRICAL LEGEND
		70 - CIVIL
12	70-C-1	OVERALL SITE PLAN
13	70-C-2	EROSION CONTROL DETAILS
		100 - INSTRUMENTATION AND CONTROL
14	100-N-60	P&ID - PRIMARY CLARIFIERS
15	100-N-61	P&ID - GAS DETECTION AND VENTILATION
16	100-N-62	P&ID 210-LCP-2100 ALARM PANEL WIRING
		110 - INFLUENT PUMP STATION
17	110-E-1	ELECTRICAL - PLAN
		210 - PRIMARY CLARIFIERS
18	210-A-1	ARCHITECTURAL - ELEVATIONS
19	210-S-1	STRUCTURAL - PLAN
20	210-S-2	STRUCTURAL - SECTIONS
21	210-S-3	STRUCTURAL - SECTIONS
22	210-S-4	STRUCTURAL - SECTIONS
23	210-M-1	PROCESS MECHANICAL - DEMOLITION PLAN
24	210-M-2	PROCESS MECHANICAL - DEMOLITION SECTIONS
25	210-M-2A	PROCESS MECHANICAL - DEMOLITION PHOTO DETAILS
26	210-M-3	PROCESS MECHANICAL - PLAN
27	210-M-4	PROCESS MECHANICAL - SECTIONS
28	210-M-5	PROCESS MECHANICAL - SECTIONS
29	210-M-6	PROCESS MECHANICAL - DETAILS
30	210-H-1	HVAC - DEMOLITION PLAN
31	210-H-2	HVAC - PLAN
32	210-H-3	HVAC - SECTIONS DETAILS
33	210-E-1	ELECTRICAL - DEMOLITION PLAN
34	210-E-2	ELECTRICAL - PLAN
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36	210-E-4	ELECTRICAL - PLAN
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41	900-E-2	PHOTO DETAIL AND RISER DIAGRAMS
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43	900-E-4	SCHEDULES
44	900-E-5	DETAILS
		999 - STANDARD DETAILS
45	999-S-1	STRUCTURAL - STANDARD DETAILS

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73607PE
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NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD

A

A	AMMETER, AMPERES, AWNINGS, AMBER, ANALOG, ABOVE COUNTER
AA	AIR TO AIR
AB	ANCHOR BOLT, ABOVE
ABDN	ABANDON
AC	ACOUSTICAL, ACOUSTICAL CEILING, ALTERNATING CURRENT, ASPHALTIC CONCRETE
ACFL	ACCESS FLOORING
ACI	AMERICAN CONCRETE INSTITUTE
ACMU	ACOUSTICAL CONCRETE MASONRY UNIT, ACOUSTICAL CMU
ACP	ACOUSTICAL PANELS
ACST	ACOUSTICAL
ACT	ACOUSTICAL CEILING TILE
AD	AREA DRAIN, ADMINISTRATION BUILDING
ADDL	ADDITIONAL
ADJ	ADJACENT
ADW	DRY WEATHER AVERAGE
AF	AMPERE FRAME
AFD	ADJUSTABLE FREQUENCY DRIVE
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AFS	AIR FLOW SWITCH
AG	ACOUSTICAL, ACOUSTICAL GLASS
AGGR	AGGREGATE
AHF	ACTIVE HARMONIC FILTER
AHR	ANCHOR
AISC	AMERICAN INSTITUTE OF STEEL CONSTRUCTION
AJ	ADJUSTABLE
AL	ALUMINUM
ALKY	ALKALINITY
ALTN	ALTERNATE
AM	AUTO-MANUAL
AMRD	ACOUSTICAL METAL ROOF DECKING
ANDZ	ANODIZE
AO	AIR TO OIL
APPROX	APPROXIMATE
APVD	APPROVED
ARCH	ARCHITECTURAL
AR	ANALOG RELAY
ARWB	ABUSE RESISTANT BOARD
AS	ADJUSTABLE SPEED, AMMETER SWITCH, AMPERE SENSOR, AS SELECTED
ASU	AIR SUPPLY UNIT
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AV	AIR VENT
AVG	AVERAGE
AW	ACID WASTE
AWW	WET WEATHER AVERAGE
@	AT

B

B	BELL
B&B	BALLED & BURLAPPED
B.O.B.	BOTTOM OF BEAM
BAL	BALANCE
BC	BARE COPPER, BOLT CIRCLE, BOTTOM OF CURB
BD	BALANCING DAMPER
BDD	BACKDRAFT DAMPER
BETW	BETWEEN
BF	BLIND FLANGE, BOTTOM FACE
BFV	BUTTERFLY VALVE
BFP	BACKFLOW PREVENTER/ BELT FILTER PRESS
BL	BASELINE
BLDG	BUILDING
BLK	BLOCK
BM	BEAM, BENCHMARK
BO	BOTTOM OF
BIT.	BITUMINOUS
BOD	BOTTOM OF DUCT
BOP	BOTTOM OF PIPE
BOT	BOTTOM
BRG	BEARING
BRK	BRICK
BRKR, BKR	BREAKER
BSP	BLACK STEEL PIPE
BV	BALL VALVE, BLOCK VENT
BVC	BEGINNING OF VERTICAL CURVE

C

C	CONDUIT, CASEMENT, CONTACTOR
°C	DEGREE CELSIUS
C TO C	CENTER TO CENTER
CA	COMPRESSED AIR
CAB	CABINET
CAL.	CALIPER
CAM	COMPUTER-AUTO-MANUAL
CAS	CONVENTIONAL ACTIVATED SLUDGE
CB	CATCH BASIN, CIRCUIT BREAKER
CC	CONTROL CABLE
CCP	CENTRAL CONTROL PANEL
CCS	CENTRAL CONTROL SYSTEM
CD	CEILING DIFFUSER, CONDENSATE DRAIN
CDF	CONTROLLED DENSITY FILL (SEE CLSM)
CDP	CONDENSER WATER PUMP
CDR	CONDENSER WATER RETURN
CDS	CONDENSER WATER SUPPLY
CE	CONSTRUCTION ENTRANCE
CEPT	CHEMICALLY ENHANCED PRIMARY TREATMENT
CFM	CUBIC FEET PER MINUTE
CFS	CUBIC FEET PER SECOND
CG	CEILING GRILLE
CH	CHILLER
CHEM	CHEMICAL
CHKD	CHECKERED
CHP	CHILLED WATER PUMP
CHS	CHILLED WATER SUPPLY
CHR	CHILLED WATER RETURN
CI	CAST IRON
CIP	CAST IRON PIPE, CAST IN PLACE
CIP	CULVERT INLET PROTECTION
CISP	CAST IRON SOIL PIPE
CJ	CONSTRUCTION JOINT
CKT	CIRCUIT
CL, ℄	CENTERLINE
CL_2 etc.	CHLORINE (TYPICAL: USE STANDARD CHEMICAL ELEMENT ABBREVIATION)
CLDI	CEMENT LINED DUCTILE IRON
CLG	CEILING
CLR	CLEARANCE
CLSM	CONTROLED LOW STRENGTH MATERIAL
CM	COMPUTER-MANUAL
CMP	CENTRAL MONITORING PANEL
CMP	CORRUGATED METAL PIPE
CMU	CONCRETE MASONRY UNIT
CNTR	COUNTER
CO	CLEANOUT, CARBON MONOXIDE
COD	CHEMICAL OXYGEN DEMAND
COL	COLUMN, COLOR
CONC	CONCRETE
COND	CONDENSATE
CONDTN	CONDITIONED
CONN	CONNECTION
CONSTR	CONSTRUCTION
CONT	CONTINUED, CONTINUOUS, CONTINUATION
CONTR	CONTRACTOR
COORD	COORDINATE
COP	COPPER
CP	CENTER PIVOT
CP-X	CONTROL PANEL NO. X
CPLG	COUPLING
CPRSR	COMPRESSOR
CPT	CONTROL POWER TRANFORMER, CARPET
CPVC	CHLORINATED PVC
CR	CONDENSATE RETURN, CONTROL RELAY
CRE	CORROSION RESISTANT NON-METALLIC
CRS	COLD ROLLED STEEL, COATED RIGID STEEL CONDUIT, CONSTRUCTION ROAD STABILIZATION
CS	CONSTANT SPEED, CONTROL STATION
CT	CERAMIC TILE, CURRENT TRANSFORMER
CTC	COMPUTER TERMINAL CABINET
CTR	CENTER
CTRD	CENTERED
CTSK	COUNTERSUNK
CU	CUBIC, COPPER
CU FT	CUBIC FOOT
CU IN, CU/IN	CUBIC INCH
CUH	COPPER TUBING, HARD DRAWN
CV	CHECK VALVE
CWR	CABINET DOOR MOUNTED WASTE RECEPTACLE
CY, CU YD	CUBIC YARD

D

D	DEEP, DRAIN
d	PENNY NAIL SIZE
DA	DUAL ACTION
DAS	DATA ACQUISITION SYSTEM
DAFT	DISSOLVED AIR FLOTATION THICKENER
DB	DECIBEL
DBA	DEFORMED BAR ANCHOR
DBL	DOUBLE
DC	DIRECT CURRENT
DCO	DECK CLEANOUT
DCS	DISTRIBUTED CONTROL SYSTEM
DCU	DISTRIBUTED CONTROL UNIT
DDC	DIRECT DIGITAL CONTROL
DDI	DROP INLET
DEG	DEGREE
DEMO	DEMOLISH, DEMOLITION
DET	DETAIL
DF	DOUGLAS FIR, DRINKING FOUNTAIN
DH	DOUBLE HUNG, DUCT HEATER, DATA HIGHWAY
DI	DUCTILE IRON, DEIONIZED WATER
DIA	DIAMETER
DIAG	DIAGONAL
DIP	DUCTILE IRON PIPE
DIR	DIRECTION
DISC	DISCONNECT
DISCH	DISCHARGE
DIV	DIVISION
DN	DOWN
DO	DISSOLVED OXYGEN
DOL	DIRECT-ON-LINE
DP, DPNL	DISTRIBUTION PANEL DISTRIBUTION PANELBOARD
DR	DOOR
DS	DOWNSPOUT, DISCONNECT
DT	DIGESTER THICKENER BUILDING
DWG	DRAWING
DWL	DOWEL
△	DELTA

E

(E), EX, EXST	EXISTING
E	EAST, EMPTY
EA	EACH, EXHAUST AIR
EAT	ENTERING AIR TEMPERATURE
EB, EBCT	EMPTY BED CONTACT TIME
ECC	ECCENTRIC
EDF	EGG-SHAPED DIGESTER FACILITY
EDH	ELECTRIC DUCT HEATER
EE	EMERGENCY EYEWASH
EF	EACH FACE, EXHAUST FAN
EFF	EFFICIENCY, EFFICIENT
EFL	EFFLUENT
EIFS	EXTERIOR INSULATION AND FINISH SYSTEM
EL, ELEV	ELEVATION
ELB	ELBOW
ELC	ELECTRICAL LOAD CENTER
ELEC	ELECTRIC, ELECTRICAL
EMBED	EMBEDMENT
EMH	ELECTRICAL MANHOLE
ENGR	ENGINEER
ENLGD	ENLARGED
EO	ELECTRICAL OPERATOR
EOP	EDGE OF PAVEMENT
EP	EXPLOSION PROOF, EDGE OF PAVING
EQ, EQPT	EQUAL, EQUIPMENT
EQL	EQUAL
EQL SP	EQUALLY SPACED
EQPT	EQUIPMENT
ES	EACH SIDE
ESP	EXTERNAL STATIC PRESSURE
ESS	EMERGENCY SHUTDOWN SWITCH
ETM	ELAPSED TIME METER
EVC	END OF VERTICAL CURVE
EW	EACH WAY
EWC	ELECTRIC WATER COOLER
EWH	ELECTRIC WALL HEATER, HANDHELD EYE WASH
EXH	EXHAUST
EXP	EXPANSION, EXPOSED, EXPOSED STRUCTURE
EXP AB	EXPANSION ANCHOR BOLT
EXP JT	EXPANSION JOINT
EX,EXST	EXISTING
EXT	EXTERIOR

F

°F	DEGREE FAHRENHEIT
F	FUSE, FILTER
FA	FOUL AIR
FATC	FIRE ALARM TERMINAL CABINET
FB	FLAT BAR
FCL_2	FREE CHLORINE RESIDUAL
F, FU	FUSE
F, FX	FIXED
FAP	FIRE ALARM PANEL
FC	FLEXIBLE CONDUIT, FLEXIBLE CONNECTION
FCA	FLANGED COUPLING ADAPTER
FCL2	FREE CHLORINE RESIDUAL
FCO	FLOOR CLEANOUT
FCTY	FACTORY
F/D	FIRE DAMPER
FD	FLOOR DRAIN
FDCO	COMBINATION FLOOR DRAIN AND CLEANOUT
FDN	FOUNDATION
FDR	FEEDER
FEXT	FIRE EXTINGUISHER
FF	FINISHED FLOOR
FFE	FINISHED FLOOR ELEVATION
FG	FINISH GRADE, FLOAT GLASS
FH	FLAT HEAD
FHY	FIRE HYDRANT
FIG	FIGURE
FL, FLR	FLOW LINE, FLOOR
FLG	FLANGE
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FLUOR	FLUORESCENT
FNSH	FINISH
FOB	FLAT ON BOTTOM
FOS	FAST-OFF-SLOW
FOSA	FAST-OFF-SLOW-AUTO
FOSR	FAST-OFF-SLOW-REMOTE
FOT	FLAT ON TOP
FP	FIELD PANEL
FP-W-X	FIELD PANEL NO. WX (W = UNIT PROCESS NUMBER X = PANEL NUMBER)
FPM	FEET PER MINUTE
FR	FORWARD-REVERSE
FRP	FIBERGLASS REINFORCED PLASTIC
FS	FAR SIDE
FSHS	FOLDING SHOWER SEAT
FT	FOOT OR FEET
FTG	FOOTING
FU	FIXTURE UNIT
FVNR	FULL VOLTAGE NON-REVERSING
FVR	FULL VOLTAGE REVERSING
FWD	FORWARD

G

G, GND	GREEN, GROUND
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GB	GYPSUM BOARD
GBT	GRAVITY BELT THICKENER
GC	GROOVED COUPLING
GCMU	GLAZED CONCRETE MASONRY UNITS
GE	GROOVED END
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GFI	GROUND FAULT INTERRUPTER
GFR	GOUND FAULT RELAY
GH	GREENHOUSE
GL	GLASS
GND	GROUND
GPD	GALLONS PER DAY
GPH	GALLONS PER HOUR
GPM	GALLONS PER MINUTE
GPS	GLOBAL POSITION SYSTEM
GR	GUARDRAIL
GRC	GALVANIZED RIGID CONDUIT SCH 40
GRTG	GRATING
GSB	GYPSUM SOFFIT BOARD
GSP	GALVANIZED STEEL PIPE
GV	GATE VALVE
GVL	GRAVEL
GWB	GYPSUM WALLBOARD
GYP	GYPSUM

H

H	HIGH OR HIGH SPEED, HORN OR HOWLER
H2S	HYDROGEN SULFIDE
H.A.S.	HEADED ANCHOR STUD
HC	HOLLOW CORE WOOD
HCG	HIGH CAPACITY RETURN OR EXHAUST GRILLE
HCL	HYDROCHLORIC ACID
HCS	HIGH-CAPACITY SUPPLY
HD	HUB DRAIN
HDNR	HARDENER
HDNS	HARDNESS
HDR	HEADER
HDW	HARDWARE
HGL	HYDRAULIC GRADE LINE
HK	HOOK
HGT	HEIGHT
HH	HANDHOLE
HHWR	HEATING HOT WATER RETURN
HHWS	HEATING HOT WATER SUPPLY
HID	HIGH INTENSITY DISCHARGE
HK	HOOK
HM	HOLLOW METAL
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
HORIZ	HORIZONTAL
HP	HORSEPOWER
HPS	HIGH PRESSURE SODIUM
HPT	HIGH POINT
HR	HOSE RACK, HANDRAIL, HOUR
HRP	HEAT RECOVERY PUMP
HS	HAND SWITCH
HSS	HOLLOW STRUCTURAL SECTION
HT	HEAT TRACE, HEIGHT
HU	HUMIDIFIER
HV	HOSE VALVE, HIGH VOLTAGE
HV-E	EXISTING HIGH VOLTAGE
HVAC	HEATING, VENTILATING AND AIR CONDITIONING
HVS	HIGH VOLTAGE SWITCH
HW	HOT WATER, SEE PIPE SCHEDULE
HWL	HIGH WATER LEVEL
HWP	HEATING WATER PUMP
HWR	HOT WATER RETURN
HWS	HOT WATER SUPPLY
HZ	HERTZ

I

IEDC	INSTRUMENTATION, ELECTRICAL, AND DATA CENTER
I & C, I/C	INSTRUMENTATION AND CONTROL
IC	INTERRUPTING CAPACITY
ID	INDUCED DRAFT, INSIDE DIAMETER
IE	INVERT ELEVATION
IEDC	INSTRUMENTATION / ELECTRICAL DATA CENTER
I.F.	INSIDE FACE
IG	INSULATING, INSULATING GLASS
IGN	IGNITOR
IH	INTAKE HOOD
IN	INCH
IMC	INTERMEDIATE METAL CONDUIT
IMP	INSULATED METAL PANELS
INCAND	INCANDESCENT
INFL	INFLUENT
INJS	INJECTIONS
INST	INSTANTANEOUS, INSTALLATION
INSTM	INSTRUMENT, INSTRUMENTATION
INSUL	INSULATION, INSULATED
INT	INTERIOR
INVT	INVERT
IP	INLET PROTECTION, INSTRUMENTATION PANEL
IRRIG	IRRIGATION
ISR	INTRINSICALLY SAFE RELAY
IT	ISOLATION TRANSFORMER
ITG	INSULATED TEMPERED GLASS
ITX	ISOLATION TRANSFORMER
IU	INTAKE UNIT
IW	IRRIGATION WELL

J

J, JB, J-BOX	JALOUSIE, JUNCTION BOX
JA	JAL-AWNING
JB	JUNCTION BOX
JAN	JANITOR
JCT	JUNCTION
JT	JOINT

K

K	KEY GROUP, KEY INTERLOCK
KIP	THOUSAND POUNDS
KIT	KITCHEN
K-PL	KICKPLATE
KSK	KITCHEN SINK
KV	KILOVOLTS
KVA	KILOVOLT AMPERES
KVAR	KILOVOLT AMPERES REACTIVE
KW	KILOWATT

L

L	ANGLE, LENGTH
LA	LIGHTNING ARRESTER
LAB	LABORATORY
LAM	LAMINATE
LAT	LATITUDE, LEAVING AIR TEMPERATURE
LB/LBS	POUND/POUNDS
LC	LIGHTING CONTACTOR
LCP	LOCAL CONTROL PANEL
LD	COMBINATION LOUVER/DAMPER
LDG	LOADING DOCK
LED	LIGHT EMITTING DIODE
LEL	LOWER EXPLOSIVE LIMIT
LF	LINEAR FEET
LG	LONG
LH	LEFT HAND
LHR	LEFT HAND REVERSE
LISW	LOAD INTERRUPTER SWITCH
LLH	LONG LEG HORIZONTAL
LLV	LONG LEG VERTICAL
LNTL	LINTEL
LONG	LONGITUDINAL
LOR	LOCAL/OFF/REMOTE

GENERAL NOTES

1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.
2. FOR ADDITIONAL ABBREVIATIONS AND SYMBOLS OF OTHER DIVISIONS, SEE OTHER LEGENDS.
3. CONTACT ENGINEER FOR ABBREVIATIONS USED BUT NOT SHOWN ON THIS DRAWING.
4. FOR PIPING CALLOUTS AND FLOW STREAM IDENTIFICATION, SEE INSTRUMENTATION AND CONTROL LEGEND.

REGISTERED PROFESSIONAL ENGINEER
73607PE
Digital Signature
OREGON
JANUARY 11, 2005
TODD WILSON DYE
EXP. 12-31-23

NO.	DATE	REVISION	DR	CHK	APVD	BY
DSGN	T DYE	S BRENNWALD	T DYE	APVD	B FULLER	

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

GENERAL
ABBREVIATIONS - 1

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-3
SHEET	3 of 45

L

LOS	LOCKOUT STOP, LOCK-OUT STOP PUSHBUTTON
LP	LIGHT POLE, LIGHTING PANELBOARD
LPS	LOW PRESSURE STEAM
LPT	LOW POINT
LR	LATCHING RELAY, LOCAL-REMOTE, LONG RADIUS
LS	LABORATORY SINK, LOW SPEED
LT	LEFT
LTF	LIQUID TIGHT FLEX
LTG, LTS	LIGHTS OR LIGHTING
LTPU	LONG TIME PICK-UP
LT(S)	LIGHT(S)
LTX	LIGHTING TRANSFORMER
LV	LOW VOLTAGE
LV-E	EXISTING LOW VOLTAGE
LWL	LOW WATER LEVEL

M

M	MOTOR, MAGNETIC CONTACTOR COIL
MA	MANUAL-AUTO
MAS	MASONRY
MATL	MATERIAL
MAU	MAKEUP AIR UNIT
MAX	MAXIMUM
MB	MACHINE BOLT
MBH	THOUSAND BTU PER HOUR
MBR	MEMBRANE BIOREACTOR
MC	MASONRY CLEARANCE, MODULATE-CLOSE
MCC	MOTOR CONTROL CENTER
MCC-X	MOTOR CONTROL CENTER NO. X
MD	MOTORIZED DAMPER
MDO	MEDIUM DENSITY OVERLAY
MDP	MAIN DISTRIBUTION PANEL
MECH	MECHANICAL
MEP	MECHANICAL, ELECTRICAL, PLUMBING
MFD	MANUFACTURED
MFR	MANUFACTURER
MGD	MILLION GALLONS PER DAY
MH	MANHOLE, MOUNTING HEIGHT, METAL HALIDE
MIN	MINUMUM
MISC	MISCELLANEOUS
MJ	MECHANICAL JOINT
MLO	MAIN LUGS ONLY
MMDW	DRY WEATHER MAXIMUM MONTH
MMP	MECHANICAL MOUNTING PANEL
MMWW	WET WEATHER MAXIMUM MONTH
MO	MANUAL OPERABLE, MASONRY OPENING, MOTOR OPERATOR
MP	METAL PANEL
MPU	MULTIPURPOSE UNIT
MS	MANUFACTURER'S STANDARD, MOTOR STARTER
MSB	MAIN SWITCHBOARD
MSC	MANUFACTURER SUPPLIED CABLE
MSR	GROUPED MOTOR CONTROL
MT	MOUNT
MTD, MT(D)	MOUNTED, MOUNT(ED)
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH
MTS	MILL TYPE STEEL PIPE
MU	MULCHING
MV	MERCURY VAPOR
MWS	MAXIMUM WATER SURFACE
M15D	MAXIMUM 15-DAY
M30D	MAXIMUM 30-DAY

N

N	NORTH, NEUTRAL
NA	NOT APPLICABLE, NON-AUTOMATIC
NC	NORMALLY CLOSED
NEUT	NEUTRAL
NA	NON-AUTOMATIC
NG	NATURAL GAS
NGVD	NATIONAL GEODETIC VERTICAL DATUM
NIC	NOT IN CONTRACT
NIT	NITROGEN PURGE CONNECTION
NL	NIGHT LIGHT
NO, N.O.	NORMALLY OPEN
NO.#	NUMBER
NOM	NOMINAL
NP	NON-PROTECTED, NAMEPLATE
NPT	NATIONAL PIPE THREADS
NS	NON-SHRINK
NTS	NOT TO SCALE
NW	NORTHWEST

O

O2	OXYGEN
OA	OUTSIDE AIR
OBD	OPPOSED BLADE DAMPER
OC, O.C.	ON CENTER, OPEN-CLOSE (D), OPEN-CLOSE (O)
OCA	OPEN-CLOSE-AUTO
OCR	OPEN-CLOSE-REMOTE
OD	OUTSIDE DIAMETER, OVERFLOW DRAIN
O.F.	OUTSIDE FACE
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OFOI	OWNER FURNISHED, OWNER INSTALLED
OG	OBSCURE
OL	OVERLOAD RELAY
OO	ON-OFF
OOA	ON-OFF-AUTO
OOR	ON-OFF-REMOTE
OP	OPAQUE PANEL, OUTLET PROTECTION
OPER	OPERATOR
OPNG	OPENING
OPP	OPPOSITE
ORP	OXIDATION REDUCTION POTENTIAL
OS	OCCUPANCY SWITCH
OSC	OPEN-STOP-CLOSE
OSD	OPEN SITE DRAIN
OTOO	OUT TO OUT
OWSJ	OPEN WEB STEEL JOIST
OZ	OUNCE

P

P	PROJECTED, PILASTER, PIPE
PAVT	PAVER TILE
PB	PUSHBUTTON SWITCH, PROCESS BUILDING, PULLBOX
PC5	PRIMARY CLARIFIER 5
PC	POINT OF CURVE, PHOTOCELL, PRECAST CONCRETE PANEL, POWER CABLE, POWER CENTER
	PUMPED CONDENSATE
PCC	POINT OF COMMON COUPLING
PCCP	PRECAST CONCRETE CYLINDER PIPE
PCD	PERFORATED CEILING DIFFUSER
PCV	PRESSURE CONTROL VALVE
PD	PANCAKE DIGESTER
PE	PLAIN END
PED	PEDESTAL, PEDESTRIAN
PEP	POLYETHYLENE PIPE
PEN.	PENETRATION
PERP	PERPENDICULAR
PF	POWER FACTOR
PFC	POUNDS PER CUBIC FOOT
PH	PENTHOUSE, PHASE
pH	HYDROGEN ION CONCENTRATION
PHF	PASSIVE HARMONIC FILTER
PI	POINT OF INTERSECTION
PIT	PILOT TUBE TEST STATION
PJF	PREMOULDED JOINT FILLER
PL	PLATE (STEEL), PROPERTY LINE
PLAM	PLASTIC LAMINATE
PLAS	PLASTER, PLASTIC
PLC	PROGRAMMABLE LOGIC CONTROLLER
PMR	PHASE MONITOR RELAY
PLYWD	PLYWOOD
PNL	PANEL
PP	POWER POLE
P-P	PUSH-PULL
PPK	POWER PACK
PPL	POLYPROPYLENE LINED
PR	PAIR
PRC	POINT OF REVERSE CURVE
PRCST	PRECAST
PREFAB	PREFABRICATION
PRES	PRESSURE
PRI	PRIMARY
PRM	PERMANENT REFERENCED MARKER
PROJ	PROJECTION
PROP	PROPERTY
PRV	PRESSURE REDUCING VALVE
PS	PRESSURE SWITCH, PLASTIC SHEET, POLYCARBONATE SHEET, PAINT SYSTEM
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH, GAUGE
PT	POTENTIAL TRANSFORMER, POINT, POINT OF TANGENCY, PRESSURE TREATED
PTD	PAPER TOWEL DISPENSER
PTN	PARTITION
PV	PLUG VALVE
PVC	POLYVINYL CHLORIDE, POLYVINYL CHLORIDE CONDUIT
PVI	POINT OF VERTICAL CURVE
PVMT	PAVEMENT
PVT	POINT OF VERTICAL TANGENCY
PW1	POTABLE WATER
PW2	INDUSTRIAL WATER
PW3	PLANT WATER

Q

QAA	AVERAGE FLOW
QMM	MAXIMUM 30 DAY FLOW
QPI	PEAK INSTANTANEOUS FLOW
QPP	PEAK PUMPING FLOW
QT	QUARRY TILE
QTY	QUANTITY

R

R	RISER, RED
R OR RAD	RADIUS
RA	RETURN AIR
RC	REINFORCED CONCRETE
RCC	REINFORCED CONCRETE CYLINDER PIPE
RCP	REINFORCED CONCRETE PIPE
RCPT	RECEPTACLE
RD	ROAD, ROOF DRAIN, ROUND
RDCR	REDUCER
RDW	REDWOOD
R.E.	RESIDENT ENGINEER
RECIR	RECIRCULATION
REF	REFER OR REFERENCE
REFR	REFRIGERATE, REFRIGERANT
REINF	REINFORCED, REINFORCING, REINFORCE
REQD	REQUIRED
REQM	REQUIREMENT(S)
RESIL	RESILIENT
RFS	ROLL-UP FIRE SHUTTER
RG	REFLECTIVE
RGS	RIGID GALVANIZED STEEL
RH	RIGHT HAND
RH	RODHOLE
RHR	RIGHT HAND REVERSE
RIO	REMOTE I/O UNIT
RJ	RESTRAINED JOINT
RL	RAIN LEADER, REFRIGERANT LIQUID
RLS	RUBBER LINED STEEL
RM	ROOM
RM-X	REMOTE MULTIPLEXING MODULE NO. X
RO	ROUGH OPENING
ROL	RAISE-OFF-LOWER
RPM	REVOLUTIONS PER MINUTE
RPZ	ROOT PROTECTION ZONE
RR	RIPRAP
RRUB	RADIAL RUBBER
RS	RIGID STEEL, REFRIGERANT SUCTION, RIGID STEEL CONDUIT
RST	REINFORCING STEEL
RT	RIGHT
RTN	RETURN
RTO	REGENERATIVE THERMAL OXIDIZER
RTU	REMOTE TERMINAL UNIT
RTU-X	REMOTE TELEMETRY UNIT NO. X
RUB	RUBBER
RUBC	RUBBER CUSHIONED FLOORING
RUBS	RUBBER ESD CONTROL FLOORING
RVNR	REDUCED VOLTAGE NON-REVERSING
RVR	REDUCED VOLTAGE REVERSING
R/W	RIGHT OF WAY
RWL	RAIN WATER LEADER

S

S	I-BEAM
S	SLOPE, SOUTH, SWITCH
SA	SUPPLY AIR, SURGE ARRESTOR
SATC	SUSPENDED ACCUSTICAL TILE CEILING
SB	SEDIMENT BASIN
SC	SHOWER CURTAIN, SOLID CORE WOOD
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SCC	SOLID CORE
SCCR	SHORT CIRCUIT CURRENT RATING
SCFM	STANDARD CUBIC FEED PER MINUTE
SCH, SCHED	SCHEDULE
SCU	SPEED CONTROL UNIT
SD	SILO DIGESTER, SMOKE DETECTOR, SOAP DISPENSOR, STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SDP	SUB-DISTRIBUTION PANEL
SDWK	SIDEWALK
SEC	SECONDARY
SECT	SECTION
SED	SEDIMENTATION
SEP	SEPTAGE
SEW	SEWAGE
S.F.	SQUARE FEET
SF	SUPPLY FAN, SLOWER-FASTER
SG	LAMINATED SAFETY GLASS, SAFETY
SGWB	SUSPENDED GYPSUM WALL BOARD
SH	SHEET
SHA	SURFACE HARDENING AGENT
SHS	SOLIDS HANDLING SYSTEM
SHTG	SHEATHING
SIM	SIMILAR
SK	SINK
SLR	SEALER
SMLS	SEAMLESS EPOXY
S/N	SOLID NEUTRAL
SOG	SLAB ON GRADE
SOI	SPRAY- ON INSULATION
SOLN	SOLUTION
SOP	STANDARD OPERATION PROCEDURE
SP	SPACE OR SPACES, SPANDREL PANEL, STORMPROOF
SPD	SPEED
SPEC, SPECS	SPECIFICATIONS
SPD	SUMP PUMP DISCHARGE
SPG	SPACING
SPLY	SUPPLY
SQ	SQUARE
SQ FT	SQUARE FOOT, FEET
SQ IN	SQUARE INCH
SR	SHORT RADIUS
SS	START-STOP, SANITARY SEWER
SSC	SUPERVISORY SET POINT CONTROL
SSMH	SANITARY SEWER MANHOLE
SST, SS	STAINLESS STEEL
ST	STRAIGHT, SHUNT TRIP
STA	STATUS
STD	STANDARD
STIF	STIFFENER
STIRR	STIRRUP
STL	STEEL
STRL	STRUCTURAL
STRUCT	STRUCTURE
SUBFL	SUBFLOOR
SUSP	SUSPENDED
SV	SOLENOID VALVE
SVIN	SHEET VINYL
SW	SWITCH
SWBD	SWITCHBOARD
SWG	SIDE-WALL GRILL
SWGR	SWITCHGEAR
SYMM	SYMMETRICAL

T

T	THERMOSTAT, TREAD, THICKNESS, TRANSFORMER
T&B	TOP AND BOTTOM
T&G	TONGUE AND GROOVE
TA	TRANSFER AIR
TAN	TANGENT
TB	TERMINAL BOARD
TBD	TO BE DETERMINED
TBG	TUBING
TC	TIME TO CLOSE, TOP OF CURB, TOP OF CONCRETE
TCAD	TIME CLOSE AFTER DE-ENERGIATION
TCAE	TIME CLOSE AFTER ENERGIZATION
TCL_2	TOTAL CHLORINE RESIDUAL
TCU	TERMINAL CONTROL UNIT
TD	TEMPERATURE DETECTOR RELAY
TDH	TOTAL DYNAMIC HEAD
TDR	TIME DELAY RELAY
TECH	TECHNICAL
TEFC	TOTALLY ENCLOSED FAN COOLED MOTOR
TEL	TELEPHONE
TEMP	TEMPORARY, TEMPERATURE
TF	TOP FACE
TFG	TEMPERED FLOAT GLASS
TG	TEMPERED
TH	TOP-HINGED
THD	THREAD
THK	THICKNESS
THRU	THROUGH
TJB	TERMINAL JUNCTION BOX
TL	TEFLON LINED PIPE, TWIST LOCK
T.O.	TIME OPEN, TIME TO OPEN, TOP OF
T.O.E.	THREADED ON END
TOAE	TIME OPEN AFTER ENERGIZATION
TOEC	TOP OF EXST CONCRETE
TOC	TOP OF CONCRETE, TOTAL ORGANIC CARBON
TOD	TIME ON DELAY, TOP OF DUCT, TOTAL OXYGEN DEMAND
TOF	TOP OF FOOTING
TOG	TOP OF GROUT, TOP OF GRATING
T.O.M.	TOP OF MASONRY
T.O.P.	TOP OF PIPE
TOS	TOP OF SLAB
TOW	TOP OF WALL
TP	TURNING POINT
TPO	THERMOPLASTIC POLYOLEFIN
TR	TRANSOM, TRUSS
TRANS	TRANSFORMER, TRANSITION
TRANSV	TRANSVERSE
TRD	TREAD
TS	AUTO TRANSFORMER, TEMPORARY SEEDING, TUBE STEEL, TEMPERATURE SENSOR
TSHT	THRESHOLD
TSP	TWISTED SHIELDED PAIR
TSS	TOTAL SUSPENSION SOLIDS
TST	TOP OF STEEL, TWISTED SHIELDED TRIAD
TTC	TELEPHONE TERMINAL CABINET
TTD	TOILET TISSUE DISPENSER
TU-X	TREATMENT UNIT NO. X
TURB	TURBIDITY
TW	TOP OF WALL
TWP	TRANSLUCENT WALL PANEL
TX	TRANSFORMER
TYP, (TYP)	TYPICAL

U

UC(RF)	UNDER COUNTER (REFRIGERATOR, ETC)
UH	UNIT HEATER (ELECTRIC)
UON	UNLESS OTHERWISE NOTED
UNO	UNLESS NOTED OTHERWISE
UPS	UNINTERRUPTIBLE POWER SUPPLY
USB	UNIT SUBSTATION
UVR	UNDER VOLTAGE RELAY

V

V	VENT, VALVE, VOLT, VOLTMETER, VOLTMETER, VOLTS
VA	VOLT AMPERES
VAC	VACUUM
VB	VAPOR BARRIER (RETARDER)
VC	VERTICAL CURVE
VCD	VARIABLE CEILING DIFFUSER
VHC	VOLATILE HYDROCARBONS
VCP	VITRIFIED CLAY PIPE
VCT	VINYL COMPOSITION TILE
VEL	VELOCITY
VERT	VERTICAL
VHC	VOLATILE HYDROCARBONS
VIB	VIBRATION
VIN	VINYL
VINT, VT	VINYL TILE
VP	VERTICAL PIVOTED
VPS	VENEER PLASTER SYSTEM
VPC	POINT OF VERTICAL CURVATURE
VPI	POINT OF VERTICAL INTERSECTION
VPT	POINT OF VERTICAL TANGENT
VR	VAPOR RETARDER
VS	VERTICAL SLIDE, VOLTMETER SWITCH
VSD	VARIABLE SPEED DRIVE
VTR	VENT THRU ROOF, VENT TO ROOF
VWC	VINYL WALL COVERING

W

W, WF	WASTE, WATT, WIDE, WIRE, WIDE FLANGE (STEEL)
W/	WITH
W1	WATER - POTABLE
W2	WATER - NON-POTABLE (CITY SOURCE)
W3	WATER - NON-POTABLE (CAS/MBR EFFLUENT)
W5	WATER - NON-POTABLE (FLUSHING-CAS EFFLUENT)
W6	WATER - REUSE (CHLORINATED MBR EFFLUENT)
WEASTRIP	WEATHERSTRIP
WC	WATER CLOSET, WATER COLUMN
WCO	WALL CLEANOUT
WG	WIRE, WIRE GLASS
WH	WATT HOUR METER
WHA	WATER ARRESTOR
WHD	WATT HOUR DEMAND METER
WHM	WATT HOUR METER
WP	WATERPROOF, WEATHERPROOF, WORKPOINT
WQRA	WATER QUALITY RESOURCE AREA
WR	WASTE RECEPTACLE
WRB	WATER RESISTANT GWB
WS	WATER SURFACE, WATERSTOP, WELDED STEEL
WSR	WALL SUPPLY REGISTER
WWF	WELDED WIRE FABRIC
WWPH	WET WEATHER PEAK HOUR

X

XFMR	TRANSFORMER
Δ	DIFFERENCE
Σ	SUM
X	MULTIPLY
÷	DIVIDE
$f(x)_n$	CHARACTERIZED
X	RAISE TO THE Nth POWER
√‾	SQUARE ROOT
AVG	AVERAGE
1:1	REPEAT OR BOOST
>	SELECT HIGHEST SIGNAL
<	SELECT LOWEST SIGNAL
}	BIAS
%	GAIN OR ATTENUATE

GENERAL NOTES

1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.
2. FOR ADDITIONAL ABBREVIATIONS AND SYMBOLS OF OTHER DIVISIONS, SEE OTHER LEGENDS.
3. CONTACT ENGINEER FOR ABBREVIATIONS USED BUT NOT SHOWN ON THIS DRAWING.
4. FOR PIPING CALLOUTS AND FLOW STREAM IDENTIFICATION, SEE INSTRUMENTATION AND CONTROL LEGEND.

REGISTERED PROFESSIONAL ENGINEER
73607PE
Digital Signature
OREGON
JANUARY 11, 2005
TODD WILSON DYE
EXP. 12-31-23

NO.	DATE	DSGN	REVISION	CHK	DR
		BY	APVD	T DYE	S BRENNWALD
		BY	APVD	T DYE	B FULLER

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

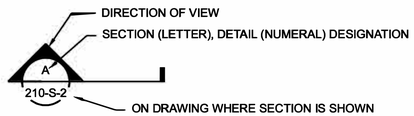
Jacobs

GENERAL
ABBREVIATIONS - 2

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-4
SHEET	4 of 45



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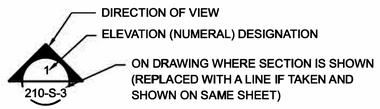

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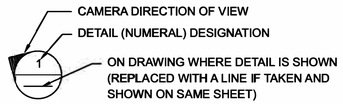

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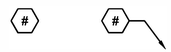
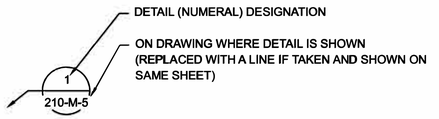
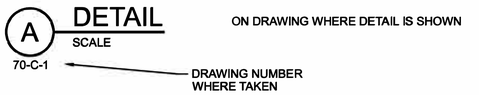
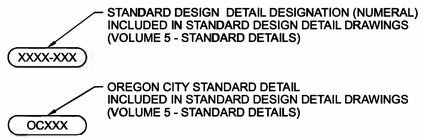


KEY NOTE DESIGNATION





DETAIL AND SECTION DESIGNATION



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2. THE TERM STANDARD DETAIL, OR A FORM OF IT, IS SYNONYMOUS WITH DESIGN DETAIL AND REFERS TO THE DESIGN DETAILS FOUND IN THIS SET OF CONTRACT DOCUMENTS.
3. SHADED ITEMS ON THE DRAWINGS INDICATE EXISTING ITEMS. BOLD ITEMS ON THE DRAWINGS INDICATE NEW ITEMS INSTALLED UNDER THIS CONTRACT.

DESIGN DETAIL DESIGNATION

DRAWING NUMBERING LEGEND

EXAMPLE:

SHEET/DRAWING NUMBER DESIGNATION

DRAWING SHEET NUMBER CONVENTIONS

TRI CITY WATER RESOURCE RECOVERY FACILITY - SOLIDS HANDLING IMPROVEMENTS

FACILITY		DISCIPLINE	
10	GENERAL	A	ARCHITECTURAL
70	CIVIL	C	CIVIL
100	INSTRUMENTATION & CONTROL	D	PROCESS MECHANICAL
110	INFLUENT PUMP STATION	E	ELECTRICAL
210	PRIMARY CLARIFIERS	G	GENERAL
420	CHLORINE BUILDING	M	BUILDING MECHANICAL/HVAC
900	ELECTRICAL	N	INSTRUMENTATION AND CONTROL
999	STANDARD DETAIL	S	STRUCTURAL
		X	DEMOLITION

REGISTERED PROFESSIONAL ENGINEER
7360TPE
Digital Signature
OREGON
JANUARY 11, 2005
TODD WILSON DYE
EXP. 12-31-23

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NO.	DATE	DR	REVISION	CHK	APVD	BY
DSGN	T DYE	S BRENNWALD		T DYE	APVD	B FULLER

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

GENERAL
GENERAL LEGEND

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-5
SHEET	5 of 45

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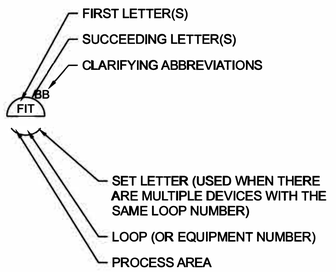
CONTRACT DOCUMENTS

INSTRUMENT IDENTIFICATION

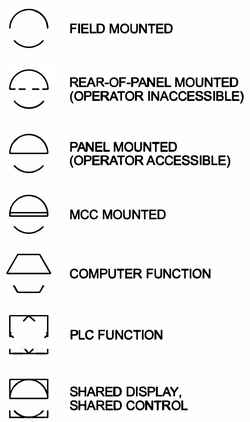
EXAMPLE SYMBOLS



SIGNAL INTERFACES

		WHERE X=
▲	ANALOG INPUT	A = ALARM
▼	ANALOG OUTPUT	H = MAINTAINED
$\triangle_X$	DISCRETE INPUT	M = MOMENTARY
∇_X	DISCRETE OUTPUT	S = STATUS

GENERAL INSTRUMENT OR FUNCTIONAL SYMBOLS



INSTRUMENT IDENTIFICATION LETTERS TABLE

LETTER	FIRST-LETTER: PROCESS OR INITIATING VARIABLE	FIRST-LETTER: MODIFIER	SUCCEEDING-LETTERS: READOUT OR PASSIVE FUNCTION	SUCCEEDING-LETTERS: OUTPUT FUNCTION	SUCCEEDING-LETTERS: MODIFIER
A	ANALYSIS (+)		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE (*)	USER'S CHOICE (*)	USER'S CHOICE (*)
C	USER'S CHOICE (*)			CONTROL	
D	DENSITY (S.G)	DIFFERENTIAL			
E	VOLTAGE		PRIMARY ELEMENT, SENSOR		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE (*)		GLASS, GAUGE VIEWING DEVICE	GATE	
H	HAND (MANUAL)				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTION	MOMENTARY			MIDDLE, INTERMEDIATE
N	TORQUE		USER'S CHOICE (*)	USER'S CHOICE (*)	USER'S CHOICE (*)
O	USER'S CHOICE (*)		ORIFICE, RESTRICTION		
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD OR PRINT		
S	SPEED, FREQUENCY	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
X	UNCLASSIFIED (+)	X AXIS	UNCLASSIFIED (+)	UNCLASSIFIED (+)	UNCLASSIFIED (+)
Y	EVENT, STATE OR PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION	Z AXIS		DRIVE, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

TABLE BASED ON THE INSTRUMENTATION, SYSTEMS, AND AUTOMATION SOCIETY (ISA) STANDARD.

(+) WHEN USED, EXPLANATION IS SHOWN ADJACENT TO INSTRUMENT SYMBOL. SEE ABBREVIATIONS AND LETTER SYMBOLS.

(*) WHEN USED, DEFINE THE MEANING HERE FOR THE PROJECT

SPECIAL CASES

ON AND OFF EVENT LIGHTS

ON-OFF HAND SWITCH. MAINTAINED CONTACT SWITCH (CONTROLLED DEVICE WILL RESTART ON RETURN OF POWER AFTER POWER FAILURE).

STOP-START HAND SWITCH MOMENTARY CONTACT SWITCHES (CONTROLLED DEVICE WILL NOT RESTART ON RETURN OF POWER AFTER POWER FAILURE).

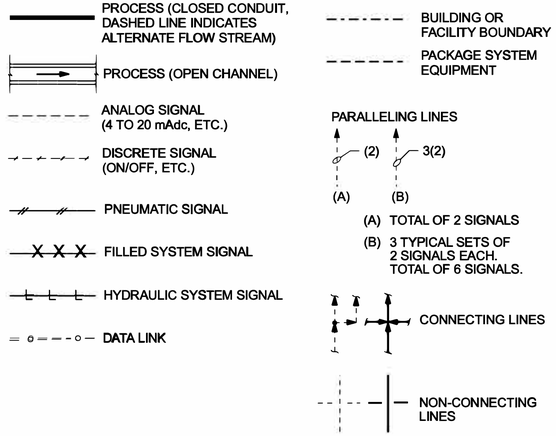
TRANSDUCERS

A	ANALOG	I	CURRENT
D	DIGITAL	P	PNEUMATIC
E	VOLTAGE	PF	PULSE FREQUENCY
F	FREQUENCY	PD	PULSE DURATION
H	HYDRAULIC	R	RESISTANCE

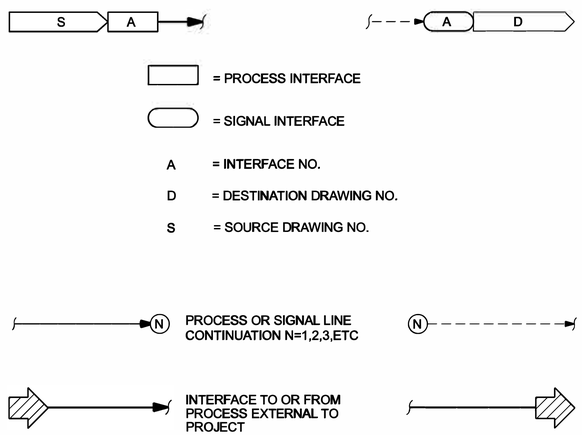
EXAMPLE:

CURRENT TO PNEUMATIC TRANSDUCER (BACK OF PANEL, IN A FLOW LOOP)

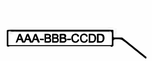
LINE LEGEND



INTERFACE SYMBOLS



EQUIPMENT TAG NUMBERS



AAA = LOCATION/BUILDING

BBB = EQUIPMENT CODE PROCESS AREA

CC = LOOP OR EQUIPMENT NUMBER

DD = EQUIPMENT SUFFIX

ABBREVIATIONS & LETTER SYMBOLS

AC	ALTERNATING CURRENT
AM	AUTO-MANUAL
BRG	BEARING
CAM	COMPUTER-AUTO-MANUAL
CCS	CENTRAL CONTROL SYSTEM
CG	COMBUSTIBLE GAS
CGS	CHILLED GLYCOL SOLUTION
CL_2 etc.	CHLORINE (TYPICAL: USE STANDARD CHEMICAL ELEMENT ABBREVIATION)
CM	COMPUTER-MANUAL
COD	CHEMICAL OXYGEN DEMAND
CP-X	CONTROL PANEL NO. X
DC	DIRECT CURRENT
DCS	DISTRIBUTED CONTROL SYSTEM
DCU	DISTRIBUTED CONTROL UNIT
DO	DISSOLVED OXYGEN
FCL_2	FREE CHLORINE RESIDUAL
FDU	FIBER DISTRIBUTION UNITS
FOS	FAST-OFF-SLOW
FOSA	FAST-OFF-SLOW-AUTO
FOSR	FAST-OFF-SLOW-REMOTE
FP-W-X	FIELD PANEL NO. WX (W = UNIT PROCESS NUMBER X = PANEL NUMBER)
FR	FORWARD-REVERSE
HOA	HAND-OFF-AUTO
HOR	HAND-OFF-REMOTE
ISR	INTRINSICALLY SAFE RELAY
LEL	LOWER EXPLOSIVE LIMIT
LORR	LOCAL-OFF/RESET-REMOTE
LOR	LOCAL-OFF-REMOTE
MA	MANUAL-AUTO
MC	MODULATE-CLOSE
MCC-X	MOTOR CONTROL CENTER NO. X
MSC	MANUFACTURER SUPPLIED CABLE
OC	OPEN-CLOSE (D)
OCR	OPEN-CLOSE-REMOTE
OCA	OPEN-CLOSE-AUTO
OO	ON-OFF
OOA	ON-OFF-AUTO
OOR	ON-OFF-REMOTE
ORP	OXIDATION REDUCTION POTENTIAL
OSC	OPEN-STOP-CLOSE
pH	HYDROGEN ION CONCENTRATION
PLC	PROGRAMMABLE LOGIC CONTROLLER
RIO	REMOTE I/O UNIT
RM-X	REMOTE MULTIPLEXING MODULE NO. X
RTU-X	REMOTE TELEMETRY UNIT NO. X
SF	SLOWER-FASTER
SS	START-STOP
SSC	SUPERVISORY SET POINT CONTROL
TCL_2	TOTAL CHLORINE RESIDUAL
TOC	TOTAL ORGANIC CARBON
TOD	TOTAL OXYGEN DEMAND
TURB	TURBIDITY
VFD	VARIABLE FREQUENCY DRIVE
VHC	VOLATILE HYDROCARBONS
VIB	VIBRATION
Δ	DIFFERENCE
Σ	SUM
X	MULTIPLY
$\div$	DIVIDE
f(x)	CHARACTERIZED
X^n	RAISE TO THE Nth POWER
$\sqrt{\ }$	SQUARE ROOT
AVG	AVERAGE
1:1	REPEAT OR BOOST
>	SELECT HIGHEST SIGNAL
<	SELECT LOWEST SIGNAL
}	BIAS
%	GAIN OR ATTENUATE

GENERAL NOTES

1. COMPONENTS AND PANELS SHOWN WITH A SINGLE ASTERISK (⁎) ARE TO BE PROVIDED AS PART OF A PACKAGE SYSTEM.
2. COMPONENTS AND PANELS SHOWN WITH A DOUBLE ASTERISK (⁎⁎) ARE TO BE PROVIDED UNDER DIVISION 26, ELECTRICAL.
3. THIS IS A STANDARD LEGEND. THEREFORE, NOT ALL OF THIS INFORMATION MAY BE USED ON THIS PROJECT.
4. SHADED ITEMS ON THE DRAWINGS INDICATE EXISTING ITEMS, BOLD ITEMS ON THE DRAWINGS INDICATE NEW ITEMS INSTALLED UNDER THIS CONTRACT.

REGISTERED PROFESSIONAL ENGINEER 18113PE OREGON JULY 21, 1995 LIONEL L. WOOD
Digital Signature
EXP. 06-30-22

NO.	DATE	REVISION	DR	CHK	APVD
DSGN	M VERCAUTEREN	J BOSS	J NORDAL	APVD	B FULLER
BY					

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

GENERAL
INSTRUMENTATION AND CONTROL LEGEND - 1

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-6
SHEET	6 of 45

VALVE SYMBOLS

- GATE
- KNIFE GATE
- BUTTERFLY
- GLOBE
- BALL
- VEE- BALL
- PLUG
- SEAT PORT ECCENTRIC PLUG
- DIAPHRAGM
- PINCH
- NEEDLE
- SWING CHECK
- BALL CHECK
- BACKFLOW PREVENTER
- ROTARY
- TELESCOPE
- MUD
- PRESSURE RELIEF
- VACUUM RELIEF
- PRESSURE/VACUUM RELEASE
- REGULATED SIDE PRESSURE CONTROL
- MULTI-PORT VALVES (GATE VALVE SHOWN. FOR OTHER VALVE TYPES, APPROPRIATE VALVE SYMBOL SHOWN). SEAT PORTS ARE IMPLIED BY INDICATED FLOW PATTERN.
- ANGLE GATE
- SAMPLE
- PRESSURE REGULATING (CLAY-TYPE)
- BALANCING
- DOUBLE LEAF CHECK VALVE
- FLAME CHECK
- AIR RELEASE, VACUUM RELEASE, OR COMBINATION AIR VALVE

GATE SYMBOLS

- SLUICE
- BUTTERFLY
- FABRICATED SLIDE
- FLAP
- STOP LOG

ACTUATOR SYMBOLS

- XX PNEUMATIC DIAPHRAGM SPRING-OPPOSED, SINGLE OR DOUBLE ACTING
- XX PNEUMATIC CYLINDER SINGLE OR DOUBLE ACTING ACTUATED BY ONE INPUT
- XX ELECTRIC MOTOR
- XX SOLENOID
- VALVE POSITIONER
- MANUAL
- XX ELECTROHYDRAULIC
- DIAPHRAGM, DIFFERENTIAL PRESSURE
- XX HYDRAULIC
- P PNEUMATIC
- P PNEUMATIC WITH POSITIONER

NOTE:
ON LOSS OF PRIMARY POWER (PNEUMATIC, ELECTRICAL OR HYDRAULIC)

XX: FO =FAIL OPEN
FC =FAIL CLOSED
FLP=FAIL TO LAST POSITION

PRIMARY ELEMENT SYMBOLS

- PARSHALL FLUME
- WEIR
- ORIFICE PLATE
- FLOW TUBE
- PITOT-STATIC
- VORTEX METER
- LE/T LEVEL (SUBMERSIBLE PRESSURE)
- ULTRASONIC FLOWMETER
- ELECTROMAGNETIC FLOWMETER
- PROPELLER OR TURBINE METER
- THERMAL FLOWMETER
- FI ROTAMETER
- LS LEVEL (FLOAT)
- DE DENSITY METER
- XX GENERIC
- LE LEVEL (ULTRASONIC)
- LIT LEVEL (RADAR)
- LEVEL (BUBBLER TUBE)

MISCELLANEOUS SYMBOLS

- DIAPHRAGM SEAL
- BLIND FLANGE
- AIR GAP
- VENT TO ATMOSPHERE
- PLUG
- RECEPTACLE
- X PURGE SET X : W = WATER A = AIR SEE
- AIR SET
- FILTER/ REGULATOR/ GAUGE SET
- A SELF CONTAINED AIR SUPPLY
- SKIMMING MECHANISM
- SCREW
- SCREW CONVEYOR
- 120V 120 VOLT, 60 HZ POWER
- 480V 480 VOLT, 60 HZ POWER
- ANNULAR DIAPHRAGM SEAL
- RUPTURE DISK (PRESSURE)
- RUPTURE DISK (VACUUM)
- PIG INSERT POINT
- OR PIG CATCH POINT
- F FLUSHING CONNECTION
- HOSE ADAPTOR
- S SEAL WATER SET
- SIGHT GLASS
- SD SUCTION DIFFUSER
- LCPXXX PANEL CONTINUED ON SAME OR OTHER DRAWING
- PANEL OUTLINE
- PANEL NAME
- I OR I INTERLOCK
- FLEXIBLE CONNECTOR/ BELLOWS
- PULSATION DAMPENER
- FILTER
- T DRIP TRAP
- FLAME ARRESTOR
- STRAINER
- HORN/STROBE
- D DRAIN
- PLATE AND FRAME HEAT EXCHANGER
- (EXISTING) SPIRAL HEAT EXCHANGER
- SPIRAL HEAT EXCHANGER
- SHELL AND TUBE HEAT EXCHANGER
- MIXER
- INLINE SILENCER
- PIPE CAP
- CALIBRATION COLUMN
- ISR INTRINSICALLY SAFE RELAY
- BACKDRAFT DAMPER
- BUTTERFLY DAMPER
- AERATOR
- ISB INTRINSICALLY SAFE BARRIER
- BLIND FLANGE AND QUICK CONNECT
- NOZZLE
- REDUCER
- AIR SEPARATOR

PUMP AND COMPRESSOR SYMBOLS

NOTE: XX: AS ADJUSTABLE SPEED
CS-1 CONSTANT SPEED (SINGLE SPEED)
CS-2 CONSTANT SPEED (TWO SPEED)

- CENTRIFUGAL PUMP (DRY PIT) XX
- CENTRIFUGAL WET PIT PUMP OR TURBINE PUMP XX
- RECIPROCATING OR METERING PUMP (POSITIVE DISPLACEMENT) XX
- DIAPHRAGM PUMP XX
- COMPRESSOR (PISTON) XX
- BLOWER OR FAN (CENTRIFUGAL) XX
- EJECTOR
- SUBMERSIBLE SUMP PUMP XX
- PISTON PUMP XX
- POSITIVE DISPLACEMENT PUMP XX
- COMPRESSOR (CENTRIFUGAL) XX
- GEAR PUMP, BLOWER, OR GRINDER XX
- VACUUM PUMP
- ROTARY PUMP
- SCREW PUMP
- PROGRESSIVE CAVITY PUMP

REGISTERED PROFESSIONAL ENGINEER
16112PE
Digital Signature
OREGON
JULY 21, 1995
LIONEL L. WOOD
EXP. 06-30-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		M VERCAUTEREN	J BOSS	J NORDAL	APVD	B FULLER	

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GENERAL
INSTRUMENTATION AND CONTROL
LEGEND - 2

CONTRACT DOCUMENTS

SCALE: AS SHOWN	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	JUNE 2022
PROJ	692260
DWG	10-G-7
SHEET	7 of 45

GENERAL ARCHITECTURAL NOTES

1. REPETITIVE FEATURES ARE NOT DRAWN IN THEIR ENTIRETY AND SHALL BE COMPLETELY PROVIDED AS IF DRAWN IN FULL.
2. VERIFY ALL ROUGH-IN DIMENSIONS FOR EQUIPMENT PROVIDED.
3. REFER TO ARCHITECTURAL, STRUCTURAL, MECHANICAL, ELECTRICAL AND OTHER CATEGORIES OF DRAWINGS FOR ADDITIONAL NOTES.
4. VERIFY SIZE AND LOCATION OF, AND PROVIDE: REQUIRED OPENINGS THROUGH FLOORS AND WALLS, CURBS, ANCHORS AND INSERTS. PROVIDE ALL BASES AND BLOCKING REQUIRED FOR ACCESSORIES, MECHANICAL, ELECTRICAL AND OTHER EQUIPMENT.

ARCHITECTURAL MATERIAL SYMBOLS

SYMBOL	LEGEND
	CONCRETE
	RIGID INSULATION

ARCHITECTURAL LEGEND

SYMBOL	LEGEND
A	NEW REFERENCE GRID INDICATOR
FACILITY NUMBER / DOOR LETTER — XXXA	DOOR IDENTIFIER

CODE DATA 2019 OREGON STRUCTURAL SPECIALTY CODE

PRIMARY CLARIFIER

CLASSIFICATION OF WORK:
1. REPAIR (CHAPTER 34, SECTION 3404)
2. ALTERATION LEVEL 2 (CHAPTER 4, SECTION 404)

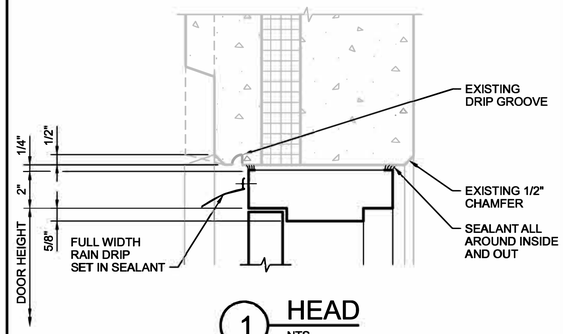
OCCUPANCY:
NO CHANGE IN OCCUPANCY

ACCESSIBILITY:
1. NOT DECREASED (CHAPTER 34, SECTION 3403.4)
2. TO OUR KNOWLEDGE, THERE ARE NO BARRIERS TO MITIGATE

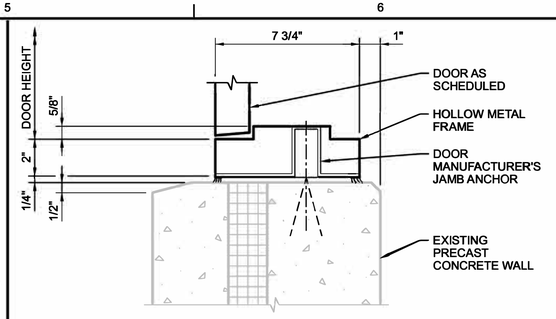
COLOR LIST

NOTES:
NO. 1 COLOR SELECTIONS FOR THIS PROJECT MAY BE NOTED IN DOOR AND HARDWARE SCHEDULE, AND ON THE DRAWINGS BY THE LETTER-NUMBER COMBINATION IN THE MARK COLUMN OF THIS LIST.
NO. 2 SOME COLOR SELECTIONS MAY BE MADE IN VARIOUS SPECIFICATION SECTIONS.
NO. 3 USE ONLY THE COLORS NOTED OR SCHEDULED. IF A COLOR SELECTION IS NOT MADE, REQUEST ONE FROM THE ARCHITECT.

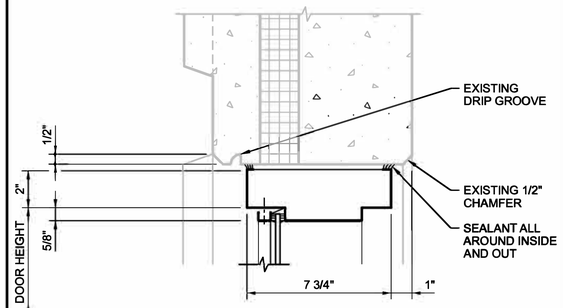
MARK	MATERIAL	MANUFACTURER (BASIS OF DESIGN OR EQUAL)	COLOR
PAINT			
P-1	PAINT (HM DOOR AND FRAME)	SHERWIN-WILLIAMS	SW6636 - HUSKY ORANGE



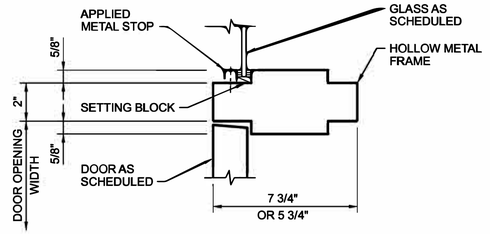
1 HEAD NTS



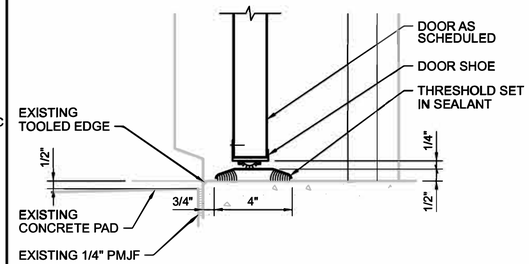
2 JAMB NTS



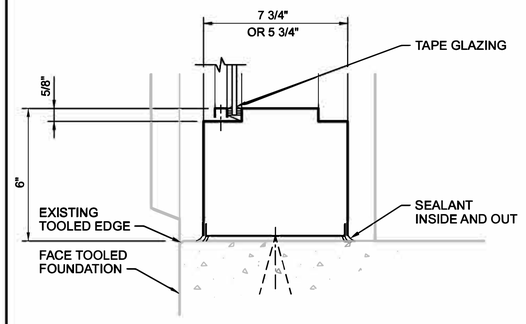
3 SIDELITE HEAD NTS



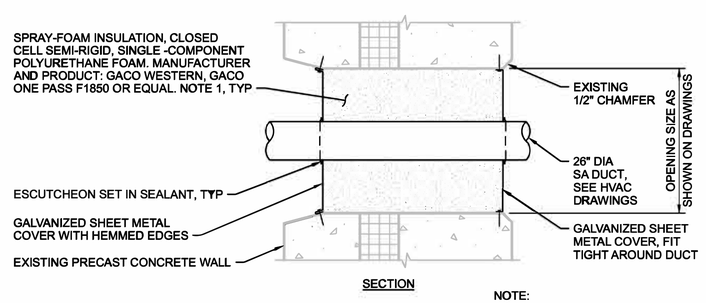
4 MULLION NTS



5 SILL NTS



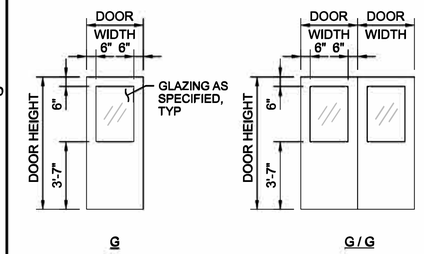
6 SIDELITE SILL NTS



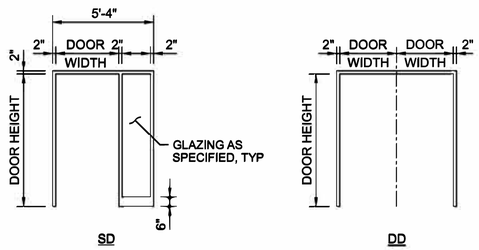
NOTE:
1. THERMAL RESISTANCE (ASTM C518): R-6.5 PER INCH THICKNESS. CORE DENSITY (ASTM D1622): 2.1 pcf. WATER VAPOR PERMEANCE (E96): 0.44 PERM-IN. AIR BARRIER ASSEMBLY AT 75 Pa (E2178): 0.00 L/sM2AT 1-INCH. FIRE RESISTANCE (ASTM E84) WITH FLAME SPREAD OF 5 OR LESS, SMOKE DEVELOPED AT 350 OR LESS.

7 DUCT FLASHING NTS
210-H-3

DOOR TYPES



DOOR FRAME TYPES



DOOR AND HARDWARE SCHEDULE

ABBREVIATIONS:

COL	COLOR
IG-C	CLEAR INSULATED GLASS
HM	HOLLOW METAL
MATL	MATERIAL

NOTES:
1. SEE THIS DRAWING FOR DOOR AND FRAME TYPES.
2. FOR DOOR DETAILS, SEE DESIGN DETAILS ON THIS DRAWING.
3. NUMBER CODE IN HARDWARE SET COLUMN REFERS TO HARDWARE SETS IN SPECIFICATION SECTION 08 71 00.
4. NUMBERS IN FNSH COLUMN REFER TO PAINT SYSTEMS IN SPECIFICATION SECTION 09 90 00.
5. CODES IN COL COLUMN REFER TO COLOR LIST ON THIS DRAWING.
6. FIELD VERIFY ROUGH OPENINGS.
7. FOR GLASS TYPES, SEE SPECIFICATION SECTION 08 11 00.

NO.	OPENING																	
	SIZE		DOOR					FRAME				DETAILS			HARDWARE		FIRE PROTECTION RATING	OTHER REQUIREMENTS
	WIDTH	HEIGHT	MATL	TYPE	GLASS	FINISH	COL	MATL	TYPE	FINISH	COL	HEAD	JAMB	SILL	SET NO.	KEY SIDE		
210A	3'-0", NOTE 6	7'-2", NOTE 6	HM	G	IG-C	4	P-1	HM	SD	4	P-1	1 / 3	2 / 4	5 / 6	2	EXT	---	
210B	3'-0", NOTE 6	7'-2", NOTE 6	HM	G	IG-C	4	P-1	HM	SD	4	P-1	1 / 3	2 / 4	5 / 6	2	EXT	---	
210C	3'-0", NOTE 6	7'-2", NOTE 6	HM	G	IG-C	4	P-1	HM	SD	4	P-1	1 / 3	2 / 4	5 / 6	2	EXT	---	
210D	(2) 3'-0", NOTE 6	7'-2", NOTE 6	HM	G/G	IG-C	4	P-1	HM	DD	4	P-1	1	2	5	1	EXT	---	

REGISTERED ARCHITECT MARK SHARP 13542 BELLEVUE, WASHINGTON 6/30/2022 STATE OF OREGON
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NO.	DATE	REVISION	DR	CHK	APVD	BY
DSGN		E GRAY	S BRENNWALD	M SHARP	APVD	B FULLER

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GENERAL

ARCHITECTURAL GENERAL NOTES, MATERIAL SYMBOLS, LEGEND, LIFE SATEFY PLAN SCHEDULES

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-8
SHEET	8 of 45

MECHANICAL LEGEND AND NOTES

GENERAL PIPING NOTES

1. LAY PIPE TO UNIFORM GRADE BETWEEN INDICATED ELEVATION POINTS.
2. SIZE OF FITTINGS SHOWN ON PLANS SHALL CORRESPOND TO ADJACENT STRAIGHT RUN OF PIPE, UNLESS OTHERWISE INDICATED. TYPE OF JOINT AND FITTING MATERIAL SHALL BE THE SAME AS SHOWN FOR ADJACENT STRAIGHT RUN OF PIPE.
3. LOCATION AND NUMBER OF PIPE HANGERS AND PIPE SUPPORTS SHOWN IS ONLY APPROXIMATE. MAXIMUM SPACING SHALL BE AS SPECIFIED.
4. ALL JOINTS SHALL BE WATERTIGHT. WALL PIPES SHALL BE USED WHEREVER PIPING PASSES FROM A STRUCTURE TO BACKFILL UNLESS OTHERWISE SHOWN.
5. ALL FLEXIBLE CONNECTORS OR FLANGED COUPLING ADAPTERS SHALL BE PROVIDED WITH THRUST TIES, OR ANCHORS, UNLESS OTHERWISE NOTED. THRUST PROTECTION SHALL BE ADEQUATE FOR TEST PRESSURES SPECIFIED.
6. SYMBOLS, LEGENDS, AND PIPE USE IDENTIFICATIONS SHOWN SHALL BE FOLLOWED THROUGHOUT THE PLANS, WHEREVER APPLICABLE. NOT ALL OF THE VARIOUS PIPING COMPONENTS ARE NECESSARILY USED IN THE PROJECT.
7. NUMBER AND LOCATION OF UNIONS SHOWN ON PLANS IS ONLY APPROXIMATE. PROVIDE ALL UNIONS NECESSARY TO FACILITATE CONVENIENT REMOVAL OF VALVES AND MECHANICAL EQUIPMENT.
8. WHERE A GROOVED END COUPLING IS SHOWN, IT SHALL BE THE RIGID JOINT TYPE, UNLESS OTHERWISE SPECIFIED. WHERE A FLANGED COUPLING ADAPTER IS SHOWN, A STANDARD FLANGE
9. LOCATE REINFORCING IN WALL AND FLOOR PRIOR TO INSTALLATION OF PIPE PENETRATION. PROVIDE ENGINEER WITH LOCATION OF REINFORCING AND EXPECTED BARS TO BE DISTURBED DURING INSTALLATION. COORDINATE FINAL LOCATION AND PENETRATION DETAIL REQUIREMENTS WITH ENGINEER.

YARD PIPING LEGEND

DOUBLE LINE / SINGLE LINE

30" D / 8" D — PIPE SIZE AND FLOW STREAM

NEW	EXISTING	
		NON-FREEZE HOSE VALVE (V-X) X = NO. IN SPECIFICATIONS
		NON-FREEZE HOSE VALVE WITH HOSE RACK (V-X) X = NO. IN SPECIFICATIONS
		INDICATOR POST VALVE
		FIRE HYDRANT
		CATHODIC PROTECTION TEST STATION
		CATHODIC PROTECTION ANODE

MISCELLANEOUS PIPING SYMBOLS

	STRAINER		THERMOMETER
	SIGHT GLASS		ROTAMETER
	FLEXIBLE (ELASTOMER) PIPE CONNECTION		PIG LAUNCHER
	GAUGE WITH COCK		PIG CATCHER

NOTES:

1. THIS IS A STANDARD LEGEND SHEET. THEREFORE, NOT ALL OF THE INFORMATION SHOWN MAY BE USED ON THIS PROJECT.
2. FOR ADDITIONAL ABBREVIATIONS AND SYMBOLS OF OTHER DIVISIONS, SEE OTHER LEGENDS.
3. FOR PIPING CALLOUTS AND FLOW STREAM IDENTIFICATION, SEE PIPE SCHEDULE.
4. ONLY FLANGED END CONNECTIONS ARE SHOWN HERE FOR DOUBLE LINE FITTINGS. FITTINGS WITH OTHER END PATTERNS ARE SHOWN SIMILARLY ON THE CONSTRUCTION DRAWINGS. ALSO SEE PIPING SPECIFICATIONS.
5. SYMBOLS SHOWN HERE FOR SINGLE LINE FITTINGS ARE GENERIC ONLY. REFER TO PIPING SPECIFICATIONS FOR SPECIFIC END CONNECTIONS FOR SINGLE LINE PIPE AND FITTINGS.
6. EXISTING PIPE AND EQUIPMENT IS SHOWN LIGHT-LINED AND/OR SCREENED AND IS NOTED AS EXISTING. NEW PIPING AND EQUIPMENT IS SHOWN DARK-LINED.

PIPE, FITTING AND VALVE SYMBOLS

DOUBLE LINE	SINGLE LINE	
		EXISTING PIPE
		NEW PIPE
		EXISTING PIPE TO BE ABANDONED
		EXISTING PIPE TO BE REMOVED
		WELDED JOINT
		GROOVED END JOINT
		FLANGED JOINT
		PROPRIETARY JOINT
		HUB & SPIGOT JOINT (RUBBER GASKET)
		BALL JOINT
		ADAPTER SIDE GROOVED END ADAPTER FLANGE
		FLANGED COUPLING ADAPTER
		FLANGED COUPLING ADAPTER WITH THRUST TIES
		FLEXIBLE COUPLING
		FLEXIBLE COUPLING WITH THRUST TIES
		STEEL BELLOWS EXP JOINT
		ELASTOMER BELLOWS EXP JOINT
		ELBOW UP
		ELBOW DOWN
		TEE UP
		TEE DOWN
		LATERAL UP
		LATERAL DOWN
		CONCENTRIC REDUCER
		ECCENTRIC REDUCER
		UNION
		CAP
		ANCHOR
		ELBOW, 90 DEGREE
		CROSS
		TEE
		ELBOW, 45 DEGREE
		LATERAL
		HEAT TRACE

DOUBLE LINE	SINGLE LINE
	GATE
OR K OR	KNIFE GATE
OR OR	BUTTERFLY
OR OR	GLOBE
OR OR	BALL
	V VEE-BALL
	SEATING PORT ECCENTRIC PLUG
OR OR	NEEDLE
OR OR	DIAPHRAGM
OR OR	PINCH
OR OR	SWING CHECK
OR OR	BALL CHECK

- HOSE VALVE (HV- X) OR (V-X) X = NO. IN SPECS
- (S) SAMPLE
- MUD
- PRESSURE RELIEF
- AIR AND/OR VACUUM RELEASE
- REGULATED SIDE
- PRESSURE CONTROL
- MULTI-PORT VALVE (BALL VALVE SHOWN. FOR OTHER VALVE TYPES, APPROPRIATE VALVE SYMBOL SHOWN.) ARROWS INDICATE FLOW PATTERN. SEATING PORTS ARE IMPLIED BY INDICATED FLOW PATTERN.
- (S) SOLENOID VALVE
- (M) MOTOR OPERATED VALVE
- COMPONENTS AND PANELS TAGGED WITH THIS SYMBOL ARE PROVIDED AS PART OF PALL'S MEMBRANE EQUIPMENT SYSTEM

GATE SYMBOLS

EL. VIEW	PLAN VIEW	
		SLUICE
		BUTTERFLY
		FLAP
		SHEAR
		FABRICATED SLIDE

PIPING DESIGNATION

EXAMPLE:

10" W5 — PIPE FLOW STREAM (REFER TO PIPING SCHEDULE)

10" W5 — NOMINAL PIPE DIAMETER

REGISTERED PROFESSIONAL ENGINEER — OREGON — 17889PE — Digital Signature — 2836 — NATHAN JAMES — EXP. 12-31-23

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		S BAAR	S BRENNWALD	N EBBS	B FULLER

REVISION — BY — APVD

CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

GENERAL
PROCESS MECHANICAL LEGEND

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
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SHEET	9 of 45

CONTRACT DOCUMENTS

PLUMBING SYMBOLS

- EXISTING PIPE (SCREENED)
- NEW PIPE
- EXISTING PIPE TO BE ABANDONED
- EXISTING PIPE TO BE REMOVED
- ANCHOR
- CAP
- CLEANOUT PLUG
- ELBOW, 90 DEGREE
- ELBOW UP
- ELBOW DOWN
- CROSS
- TEE
- TEE UP
- TEE DOWN
- ELBOW, 45 DEGREE
- LATERAL
- LATERAL UP
- LATERAL DOWN
- CONCENTRIC REDUCER
- ECCENTRIC REDUCER
- UNION
- GROOVED END JOINT
- FLEXIBLE PIPE CONNECTION
- STEEL BELLOWS EXPANSION JOINT
- STRAINER
- SIGHT GLASS
- PS — PRESSURE SWITCH
- PRESSURE GAUGE WITH COCK
- THERMOMETER
- HOSE RACK (TYPE AS INDICATED)
- EYEWASH
- S — SAFETY SHOWER
- S — SAFETY SHOWER\EYEWASH COMBINATION UNIT
- HOSE VALVE

Z" YCO-X	Z = OUTLET SIZE IN INCHES Y = F - FLOOR CLEANOUT W - WALL CLEANOUT X = NO. IN SPECIFICATION
Z" HD-XY	HUB DRAIN Z = OUTLET SIZE IN INCHES X = NO. IN SPECIFICATION Y = T WITH TRAP Y = P WITH PRIMED TRAP
Z" FD-XY	FLOOR DRAIN Z = OUTLET SIZE IN INCHES X = NO. IN SPECIFICATION Y = T WITH TRAP Y = P WITH PRIMED TRAP
Z" RD-X	ROOF DRAIN Z = OUTLET SIZE IN INCHES X = NO. IN SPECIFICATION
Z" OD-X	OVERFLOW ROOF DRAIN Z = OUTLET SIZE IN INCHES X = NO. IN SPECIFICATION

HEATING, VENTILATING, AND AIR CONDITIONING SYMBOLS

- WALL REGISTER OR GRILLE (SUPPLY)
- CEILING DIFFUSER OR REGISTER (SUPPLY)
- CEILING REGISTER OR GRILLE (RETURN AND EXHAUST)
- WALL REGISTER OR GRILLE (RETURN AND EXHAUST)
- TURNING VANES
- 45 DEGREE ENTRY
- CONICAL TEE
- BELLMOUTH
- SD — SMOKE DAMPER
- FD — FIRE DAMPER
- MANUAL OPPOSED-BLADE DAMPER
- MANUAL BUTTERFLY DAMPER
- M — MOTORIZED DAMPER
- SOUND ATTENUATED DUCT
- FLEXIBLE CONNECTION
- AIRFLOW DIRECTION

HEATING, VENTILATING, AND AIR CONDITIONING SYMBOLS (CONT)

- FLEXIBLE DUCTWORK
- R — INCLINED RISE IN DUCT
- D — INCLINED DROP IN DUCT
- SUPPLY DUCT (SECTION)
- INTAKE, RETURN, OR EXHAUST DUCT (SECTION)
- T — ROOM TEMPERATURE SENSOR
- P — ROOM PRESSURE SENSOR
- HCP — HVAC CONTROL PANEL
- (200) — 200 SCFM
- IS — CURRENT SWITCH
- EVAP — EVAPORATIVE
- INFILT — INFILTRATION
- XFILT — EXFILTRATION
- XFER — TRANSFER
- VS — VARIABLE SPEED DRIVE BY EQUIPMENT VENDOR

PLUMBING GENERAL NOTES

1. THE SUBCONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS, VERIFY EXISTING PLUMBING PIPING SYSTEMS AND VERIFY NEW POINTS OF CONNECTION TO EXISTING PIPING PRIOR TO PERFORMING WORK.
2. ALL PIPE PENETRATIONS THROUGH FLOORS AND WALLS SHALL BE SLEEVED AND SEALED.
3. PIPING ELEVATIONS SHOWN ARE APPROXIMATE, FIELD VERIFY PIPING ELEVATIONS WITH NEW AND EXISTING CONDITIONS PRIOR TO INSTALLATION.
4. THE CONTRACTOR SHALL PROVIDE OFFSETS IN THE PIPING RUNS, IN ADDITION TO WHAT IS SHOWN ON THE DRAWINGS, WHERE REQUIRED TO CLEAR EXISTING AND NEW; HVAC, STRUCTURAL, ARCHITECTURAL, ELECTRICAL, MECHANICAL AND OTHER SYSTEMS.
5. REFER TO ARCHITECTURAL DRAWINGS FOR EXACT LOCATION OF PLUMBING FIXTURES, VENTS THRU ROOF AND ROOF DRAINS.
6. COORDINATE FINAL LOCATIONS OF FLOOR AND HUB DRAINS THAT RECEIVE CONDENSATE DRAINAGE FROM HVAC EQUIPMENT.
7. PROVIDE CLEANOUTS IN ROOF DRAIN PIPING, ROOF OVERFLOW DRAIN PIPING AND SANITARY WASTE PIPING AS SHOWN ON THE DRAWINGS. FURNISH AND INSTALL ADDITIONAL CLEANOUTS AS REQUIRED BY CODE.

GENERAL DRAWING NOTES

THIS IS A STANDARD LEGEND SHEET. SOME SYMBOLS OR ABBREVIATIONS ON THIS SHEET MAY NOT APPEAR ON THE PLANS.

FOR ABBREVIATIONS, SEE THE GENERAL ABBREVIATIONS SHEETS ON 10-G-004, 01-G-005.

REGISTERED PROFESSIONAL ENGINEER — 14566 — Digital Signature — OREGON — JULY 26, 2005 — JAMES H. SAYLOR — EXP: 06-30-22

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

GENERAL
HVAC AND PLUMBING LEGEND

CONTRACT DOCUMENTS

SCALE: AS SHOWN
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DATE	JUNE 2022
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SHEET	10 of 45

ONE-LINE DIAGRAM

SYMBOL	DESCRIPTION
400	CIRCUIT BREAKER, THERMAL MAGNETIC TRIP SHOWN, 3 POLE, UNO
AS/AF or AT/AF	CIRCUIT BREAKER, STATIC TRIP UNIT, SENSOR AMP TRIP AND FRAME RATINGS SHOWN, 3 POLE, UNO
100/M	CIRCUIT BREAKER, MAGNETIC TRIP ONLY, TRIP RATING SHOWN, 3 POLE, UNO
400 400	CIRCUIT BREAKER WITH CURRENT LIMITING FUSES, TRIP AND FUSE RATING INDICATED, 3 POLE, UNO
400 225	FUSED SWITCH, SWITCH AND FUSE CURRENT RATING INDICATED, 3 POLE, UNO
100	SWITCH, CURRENT RATING INDICATED, 3 POLE, UNO
60 (3)	FUSE, CURRENT RATING AND QUANTITY INDICATED
1	MAGNETIC STARTER WITH OVERLOAD, NEMA SIZE INDICATED, FVNR UNO
	CABLE OR BUS CONNECTION POINT
3	AC MOTOR, SQUIRREL CAGE INDUCTION - HORSEPOWER INDICATED
	GROUND
15 KVA 480-120/240V 1 PH	TRANSFORMER, SIZE, VOLTAGE RATINGS, AND PHASE INDICATED
	CONNECTION POINT TO EQUIPMENT SPECIFIED IN OTHER DIVISIONS. RACEWAY, CONDUCTOR AND CONNECTION IN THIS DIVISION

LIGHTING SYSTEM PLAN

(1) or (1)	LUMINAIRE, SEE SCHEDULE
(1)	STRIP LUMINAIRE, SEE SCHEDULE
(4) or (4)	LUMINAIRE AND POLE, SEE SCHEDULE
(5) or (5)	WALL MOUNTED LUMINAIRE, SEE SCHEDULE
(1)	FLOOD LIGHTS - AIM IN THE DIRECTION SHOWN
	STANDBY LIGHTING UNIT, SURFACE MOUNTED, SEE SCHEDULE
XX or	EXIT LIGHTS - FILLED SECTION INDICATES LIGHTED FACE, ARROW INDICATES EGRESS DIRECTIONAL INDICATORS, XX = FIXTURE NUMBER, SEE SCHEDULE
^{a} or LP-1-XX	SMALL LETTER SUBSCRIPT AT SWITCH AND LUMINAIRE INDICATES SWITCHING. SUBSCRIPT NUMBER AT LUMINAIRE INDICATES CIRCUIT (LP-1-XX INDICATES LP-4401 CIRCUIT XX)
$_3	WALL SWITCH:

2-	DOUBLE POLE	P-	PILOT LIGHT
3-	THREE WAY	K-	KEY OPERATED
4-	FOUR WAY	D-	DIMMER
WP-	WEATHERPROOF	CRE-	CORROSION RESISTANT
EX-	EXPLOSIONPROOF	L-	MOMENTARY 3-WAY
M-	MOTOR RATED	MS-	MANUAL STARTER WITH OVERLOADS

POWER SYSTEM PLAN

SYMBOL	DESCRIPTION
	CONNECTION POINT TO EQUIPMENT SPECIFIED. RACEWAY, CONDUCTOR,TERMINATION AND CONNECTION IN THIS DIVISION.
MCC-A	MAJOR ELECTRICAL COMPONENT OR DEVICE - NAME OR IDENTIFYING SYMBOL AS SHOWN.
LPXXA	PANELBOARD - SURFACE MOUNTED
	PANELBOARD LETTER OR NUMBER
	FACILITY NUMBER
	LP - LOW VOLTAGE PANEL DP - DISTRIBUTION PANEL
	TERMINAL JUNCTION BOX
M	MOTOR, SQUIRREL CAGE INDUCTION
LPXXA	HOME RUN - DESTINATION SHOWN
[A1]	CONDUIT AND CONDUCTOR CALLOUT, SEE LEGEND.
	CONDUIT DOWN
	CONDUIT UP
	CONDUIT TERMINATION AT CABLE TRAY
EX	EXISTING CONDUIT/ DUCT BANK
CE	CONCRETE ENCASED CONDUIT
	CONCEALED CONDUIT
	CONDUIT ROUTING AREA
	CABLE TRAY
J or HH	GENERAL CONTROL OR WIRING DEVICE. LETTER SYMBOLS OR ABBREVIATIONS INDICATE TYPE OF DEVICE
CS	CONTROL STATION, SEE CONTROL DIAGRAMS FOR CONTROL DEVICE(S) REQUIRED.
30	NONFUSED DISCONNECT SWITCH, CURRENT RATING INDICATED, 3 POLE
60/40	FUSED DISCONNECT SWITCH, CURRENT RATING INDICATED (60/40, 60=SWITCH RATING / 40=FUSE RATING) 3 POLE
2	COMBINATION CIRCUIT BREAKER AND MAGNETIC STARTER, NEMA SIZE INDICATED
XX 2	CONVENIENCE RECEPTACLE - DUPLEX UNLESS NOTED OTHERWISE WP - WEATHERPROOF TL - TWIST LOCK GFCI - GROUND FAULT CIRCUIT INTERRUPTER SUBSCRIPT NUMBER AT RECEPTACLE INDICATES CIRCUIT
L20R 20	RECEPTACLE, SPECIAL PURPOSE-NEMA CONFIGURATION AND AMPERAGE INDICATED
EUH	ELECTRIC UNIT HEATER

CONTROL DIAGRAM

SYMBOL	DESCRIPTION
	PUSH-BUTTON SWITCH, MOMENTARY CONTACT, NORMALLY OPEN
	PUSH-BUTTON SWITCH, MOMENTARY CONTACT, NORMALLY CLOSED
	PUSH BUTTON SWITCH, MAINTAINED CONTACTS WITH MECHANICAL INTERLOCK
	3 POSITION SELECTOR SWITCH MAINTAINED CONTACT
HAND OFF REMOTE	SELECTOR SWITCH - MAINTAINED CONTACT - CHART IDENTIFIES OPERATION WHEN NEEDED FOR CLARITY:

	POSITION		
CKT	HAND	OFF	REMOTE
1	X	O	O
2	O	O	X

X - CLOSED CONTACT
O - OPEN CONTACT

	TOGGLE SWITCH, ON-OFF TYPE
ON OFF	SELECTOR SWITCH, ON-OFF TYPE
	MUSHROOM HEAD PUSHBUTTON SWITCH
A	INDICATING LIGHT, PUSH-TO-TEST, LETTER INDICATES COLOR
A	INDICATING LIGHT - LETTER INDICATES COLOR A - AMBER G - GREEN S - STROBE B - BLUE R - RED C - CLEAR W - WHITE
ETM	ELAPSED TIME METER
M	MOTOR STARTER CONTACTOR COIL
CRX	CONTROL RELAY, X INDICATES NUMERICAL ORDER IN CIRCUIT
TDR X	TIME DELAY RELAY, X INDICATES NUMERICAL ORDER IN CIRCUIT
SV X	SOLENOID VALVE, X INDICATES NUMERICAL ORDER IN CIRCUIT
	CONTACT - NORMALLY OPEN
	CONTACT - NORMALLY CLOSED
	REMOTE DEVICE
	TIME DELAY RELAY CONTACT, NORMALLY OPEN, CLOSES WHEN ENERGIZED AND TIMED OUT
	TIME DELAY RELAY CONTACT, NORMALLY CLOSED, OPENS WHEN ENERGIZED AND TIMED OUT
	TIME DELAY RELAY CONTACT, CLOSES WHEN ENERGIZED, OPENS WHEN DE-ENERGIZED AND TIMED OUT
	TIME DELAY RELAY CONTACT, OPENS WHEN ENERGIZED, CLOSES WHEN DE-ENERGIZED AND TIMED OUT
	MOTOR SPACE HEATER
	TERMINAL BLOCK, REMOTE
	TERMINAL BLOCK, INTERNAL
	FUSED TERMINAL BLOCK
	FUSE, RATING INDICATED
CPT 120V	TRANSFORMER, CONTROL POWER

ABBREVIATIONS

A	AMPERE, AUTOMATIC
AC	ALTERNATING CURRENT
AFD	ADJUSTABLE FREQUENCY DRIVE
AFF	ABOVE FINISHED FLOOR
ATS	AUTOMATIC TRANSFER SWITCH
BKR	BREAKER
C	CONDUIT, CONTACTOR, CONDUCTOR, CLOSE
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CT	CURRENT TRANSFORMER, CABLE TRAY
CFC	CALCULATED FAULT CURRENT
DC	DIRECT CURRENT
DP	DISTRIBUTION PANEL
E	EMPTY
F, FU	FUSE
FREQ	FREQUENCY
G	GROUND
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GND	GROUND
HH	HANDHOLE
HOA	HAND-OFF-AUTO
HP	HORSEPOWER
HS	HAND SWITCH
HZ	HERTZ
IC	INTERRUPTING CAPACITY
J, JB	JUNCTION BOX
KA	KILOAMPERES
KV	KILOVOLT
KVA	KILOVOLT AMPERES
KW	KILOWATTS
M	MAGNETIC CONTACTOR COIL, MOTOR, MANUAL
MCC	MOTOR CONTROL CENTER
MH	MANHOLE, METAL HALIDE, MOUNTING HEIGHT
NC	NORMALLY CLOSED
N.O.	NORMALLY OPEN
NTS	NOT TO SCALE
OL	OVERLOAD RELAY
PB	PULL BOX
RGS	RIGID GALVANIZED STEEL CONDUIT
S	SNAP SWITCH
SS	START STOP
SCCR	SHORT CIRCUIT CURRENT RATING
SST	STAINLESS STEEL
SV	SOLENOID VALVE
SWBD	SWITCHBOARD
TYP	TYPICAL
V	VOLTAGE, VOLTS
W	WATTS
WP	WEATHERPROOF
XFMR	TRANSFORMER

NOTES:

1. THESE ARE STANDARD LEGEND SHEETS. SOME SYMBOLS AND ABBREVIATIONS MAY APPEAR ON THE LEGEND AND NOT ON THE DRAWINGS.
2. FOR ADDITIONAL ABBREVIATIONS OF OTHER DIVISIONS (HVAC, MECHANICAL, AND STRUCTURAL/ARCHITECTURAL) SEE OTHER LEGENDS.

REGISTERED PROFESSIONAL ENGINEER — OREGON — MORGAN S. MACROSTIE — 83275PE — Digital Signature — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE	B FULLER		

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

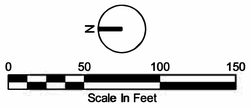
Jacobs

GENERAL
ELECTRICAL
LEGEND

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	10-G-11
SHEET	11 of 45

CONTRACT DOCUMENTS



NOTES:

1. AREA DESIGNATED FOR CONTRACTOR OFFICES. CONFIRM LIMITS AND ACCESS WITH OWNER.
2. MAINTAIN ACCESS AND OPERATIONS OF EXISTING TRAFFIC FOR BACKUP CENTRIFUGE AT ALL TIMES.
3. COORDINATE USAGE AND LIMITS OF CONTRACTOR STAGING, STORAGE, OFFICES, AND PARKING WITH OWNER.
4. STAGING FOR BYPASS PUMPING. MAINTAIN ACCESS FOR DAILY SLUDGE HAULING TRUCKS.
5. COORDINATE AREA DESIGNATED FOR LONG TERM STORAGE OF SLUDGE COLLECTOR AND HELICAL SCUM SKIMMER MECHANISMS WITH OWNER. CONTRACTOR TO STORE AND MAINTAIN EQUIPMENT PER MANUFACTURER'S REQUIREMENTS AND PER SECTION 44 42 24.02 - RECTANGULAR PRIMARY CLARIFIER MECHANISM TO MAINTAIN EQUIPMENT IN A WARRANTABLE CONDITION. PROVIDE TEMPORARY STRUCTURE FOR PROTECTION FROM WEATHER, AS REQUIRED. COORDINATE POINT OF CONNECTION FOR 120V ELECTRICAL SUPPLY WITH OWNER.
6. AVAILABLE AREA FOR ANY REQUIRED WASTE STREAM TREATMENT. PROVIDE TRAFFIC RATED PIPE CROSSING RAMP FOR UTILITIES CROSSING THE ROAD. RAMP TO BE RATED FOR SEMI TRUCK AND TRAILER TRAFFIC
7. CONTRACTOR TO REPAIR, CLEAN, AND RETURN DISTURBED LAYDOWN AND STAGING AREAS TO ORIGINAL CONDITION AND REMOVE ALL DEBRIS
8. W3 - PLANT EFFLUENT AVAILABLE TO BE PUMPED FROM CHLORINE CONTACT BASIN. SEE 01 31 13 - PROJECT COORDINATION FOR DETAILS.
9. PROTECT PERMEABLE PAVEMENT FROM CRANE OUTRIGGERS USING TRAFFIC RATED STEEL PLATES.
10. HORIZONTAL DATUM: OREGON COORDINATE REFERENCE SYSTEM, PORTLAND ZONE. THE CURRENT DATUM REALIZATION IS NAD83 (2011) EPOCH 2010.00.
11. VERTICAL DATUM: NGVD 29.
12. PRIMARY CLARIFIER ELEVATED SLAB AND ALUMINUM CHECKER PLATE RATED FOR 100 PSF LIVE LOAD. RIBBED ALUMINUM DECKING RATED FOR 25 PSF.

CONTROL POINT TABLE

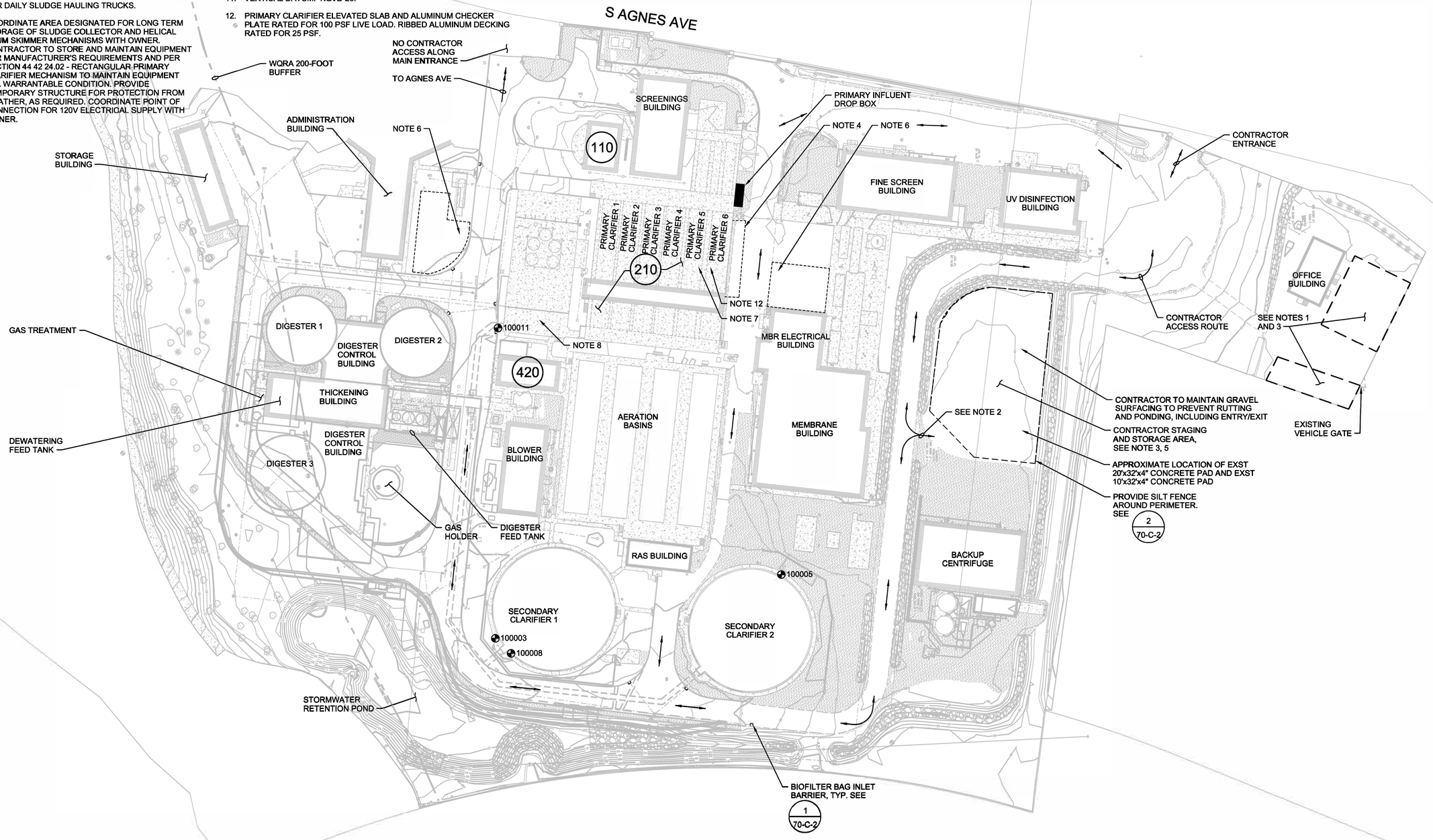
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
100003	368782.83	118920.63	45.13	FD 2" BD (NELSON 324)
100005	368845.51	118639.64	45.29	FD COMPASS BRASS SCREW
100008	368768.07	118905.17	48.90	FD BD TOP CLARIFIER WALL
100011	369087.91	118918.04	45.57	FD COMPASS ENGR CAD
100013	369418.96	119183.13	45.46	FD BD (NELSON 322)

FACILITIES

110 INFLUENT PUMP STATION

210 PRIMARY CLARIFERS

420 CHLORINE BUILDING



REGISTERED PROFESSIONAL ENGINEER
73607PE
Digital Signature
OREGON
JANUARY 11, 2005
TODD WILSON DYE
EXP. 12-31-23

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
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Jacobs

CIVIL
OVERALL SITE PLAN

SCALE: AS SHOWN
VERIFY SCALE
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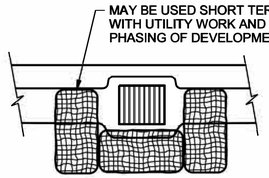
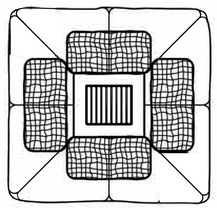


CURB INLET

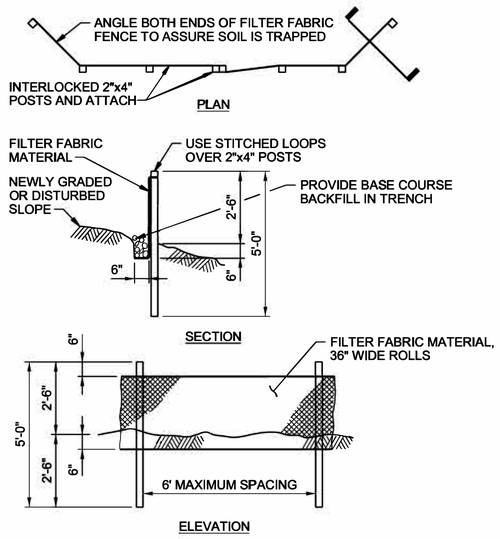


AREA DRAIN

1 BIOFILTER BAG INLET BARRIER

NTS

70-C-1



NOTES:

1. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
2. 2"x4" DOUGLAS FIR OR STEEL FENCE POSTS.
3. STITCHED LOOPS TO BE INSTALLED DOWNHILL SIDE OF SLOPE.
4. COMPACT ALL AREAS OF FILTER FABRIC TRENCH.

2 SEDIMENT FENCE

NTS

70-C-1

REGISTERED PROFESSIONAL ENGINEER
73607PE
Digital Signature
OREGON
JANUARY 11, 2005
TODD WILSON DYE

EXP. 12-31-23

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CLACKAMAS WATER ENVIRONMENT SERVICES

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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

CIVIL

EROSION CONTROL DETAILS

SCALE: AS SHOWN
VERIFY SCALE
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CP-1

PLC-1

RUNNING HI TORQUE
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MCC
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210YL
2111B
"POWER"
2 14 1

TYPICAL, SIMILAR TO BELOW

MCC
ON
210YL
2112B
"POWER"
3

MCC
ON
210YL
2113B
"POWER"
4

MCC
ON
210YL
2114B
"POWER"
5

MCC
ON
210YL
2115B
"POWER"
6

MCC
ON
210YL
2116B
"POWER"
7

MCC
ON
210YL
2111A
"POWER"
8

MCC
ON
210YL
2112A
"POWER"
9

MCC
ON
210YL
2113A
"POWER"
10

MCC
ON
210YL
2114A
"POWER"
11

MCC
ON
210YL
2115A
"POWER"
12

MCC
ON
210YL
2116A
"POWER"
13

PI
FROM PRIMARY INFLUENT

PI
FROM PRIMARY INFLUENT

FROM SCUM UNDERFLOW PUMPS

DW
FROM DW

FROM DEWATERING PUMP 110-2170

TO DEWATERING PUMP 110-2170

540-2363 540-2119 540-2364 540-2120

210-G-2161 210-G-2162

LSH 2161 LSH 2162

540-2111 540-2112 540-2113 540-2114 540-2115 540-2116

210-COL-2111B SLUDGE CROSS COLLECTOR (TYP)
210-COL-2112B
210-COL-2113B
210-COL-2114B
210-COL-2115B
210-COL-2116B

210QS 2111B
210QS 2112B
210QS 2113B
210QS 2114B
210QS 2115B
210QS 2116B

TO MCC, TYPICAL

210QS 2111A
210QS 2112A
210QS 2113A
210QS 2114A
210QS 2115A
210QS 2116A

210-COL-2111A LONGITUDINAL SLUDGE COLLECTOR (TYP)
210-COL-2112A
210-COL-2113A
210-COL-2114A
210-COL-2115A
210-COL-2116A

210-CS-2111B
HOA
210HS 2111B-1
RESET
210HS 2111B-2
HI TORQUE
210YL 2111B-2
ON
210YL 2111B-1
**
TYPICAL OF (12)

AUTO CONTROL FROM CP-1

MCC
(6)
HOA
210HS 2136 (6)
210YL 2136 (6)

TO PRIMARY SLUDGE PUMPS

LT 2320

PRIMARY CLARIFIER 1
210-SKM-2131
HELICAL SCUM SKIMMER (TYP)
PRIMARY CLARIFIER 2
210-SKM-2132
PRIMARY CLARIFIER 3
210-SKM-2133
PRIMARY CLARIFIER 4
210-SKM-2134
PRIMARY CLARIFIER 5
210-SKM-2135
PRIMARY CLARIFIER 6
210-SKM-2136
"POWER"

M CS

W3

TO SCUM UNDERFLOW PUMPS

TO PRIMARY SCUM PUMP

FCG 2140 510-2140 Z E M

W5

560-2130

560-2133 560-2134 560-2135 560-2136

510-2181 560-2131 560-2132 510-2186

PE
PRIMARY EFFLUENT BYPASS

TMF 120V
HS 2180 **

PRIMARY CLARIFIERS

LIC 2140
LT 2140

350-2180 **
PRIMARY EFFLUENT SAMPLER

PE
PRIMARY EFFLUENT TO AERATION BASINS

REGISTERED PROFESSIONAL ENGINEER
16112PE
Digital Signature
OREGON
JULY 21, 1995
LIONEL L. WOOD
EXP. 06-30-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD
		M.VERCAUTEREN	J.BOSS	L.WOOD			B.FULLER

REVISION

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

INSTRUMENTATION AND CONTROL
P&ID
PRIMARY CLARIFIERS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	100-N-60
SHEET	14 of 45

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420-CP-010

PLC

ALARM

SUPPLY FANS RUNNING

RUNNING

RUNNING

120V

210-LCP-2100
ALARM PANEL

RESET
210HS
2100A

SILENCE
210HS
2100B

MCC
210ISL
2101
210HS
2101
OO
**
ISL
ON
210YL
2101A
210YL
2101B

MCC
210ISL
2102
210HS
2102
OO
**
ISL
ON
210YL
2102A
210YL
2102B

120V

"POWER"

"POWER"

210AIT
2100

"MSC"

210AE
2100

210XA
2100
HORN
GO/NO-GO
INSIDE
HORN

210YL
2100A
GO/NO-GO
OUTSIDE
DOOR 1

210YL
2100B
GO/NO-GO
OUTSIDE
DOOR 2

210YL
2100C
GO/NO-GO
OUTSIDE
DOOR 3

210YL
2100D
GO/NO-GO
OUTSIDE
DOOR 4

210YL
2100E
GO/NO-GO
INSIDE
BEACON

M

CS

210-SF-2101
SUPPLY FAN 1

M

CS

210-SF-2102
SUPPLY FAN 2

REGISTERED PROFESSIONAL ENGINEER
16112PE
Digital Signature
OREGON
JULY 21, 1995
LIONEL L. WOOD
EXP. 06-30-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		M VERCAUTEREN	J BOSS	L WOOD	APVD	B FULLER	

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INSTRUMENTATION AND CONTROL

P&ID
GAS DETECTION AND VENTILATION

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

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VERIFY SCALE
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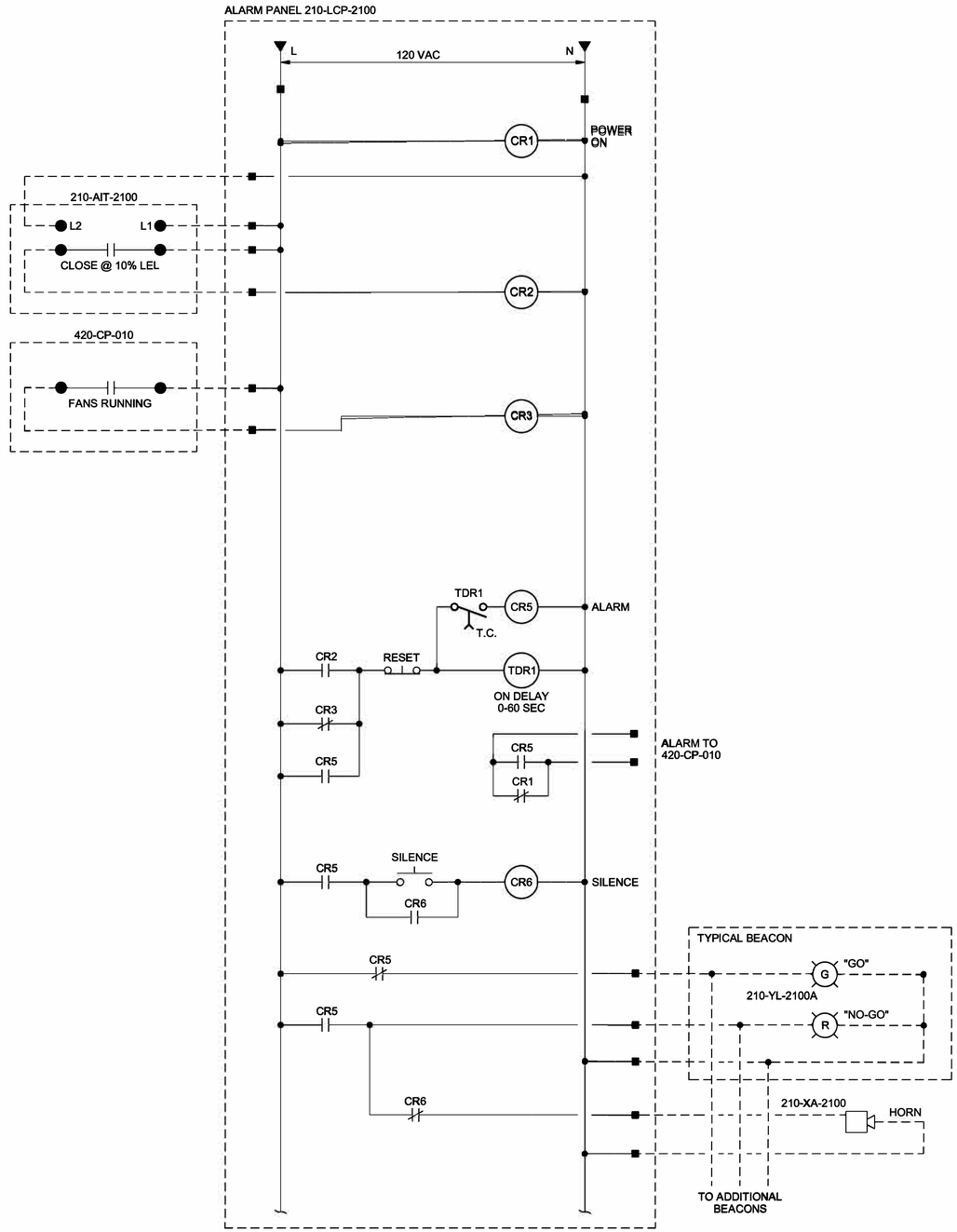
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	100-N-61
SHEET	15 of 45



REGISTERED PROFESSIONAL ENGINEER
16112PE
Digital Signature
OREGON
JULY 21, 1995
LIONEL L. WOOD
EXP. 06-30-22

NO.	DATE	DSGN	DR	CHK	APVD	BY
REVISION		M.VERCAUTEREN	J BOSS	L WOOD	APVD	B FULLER

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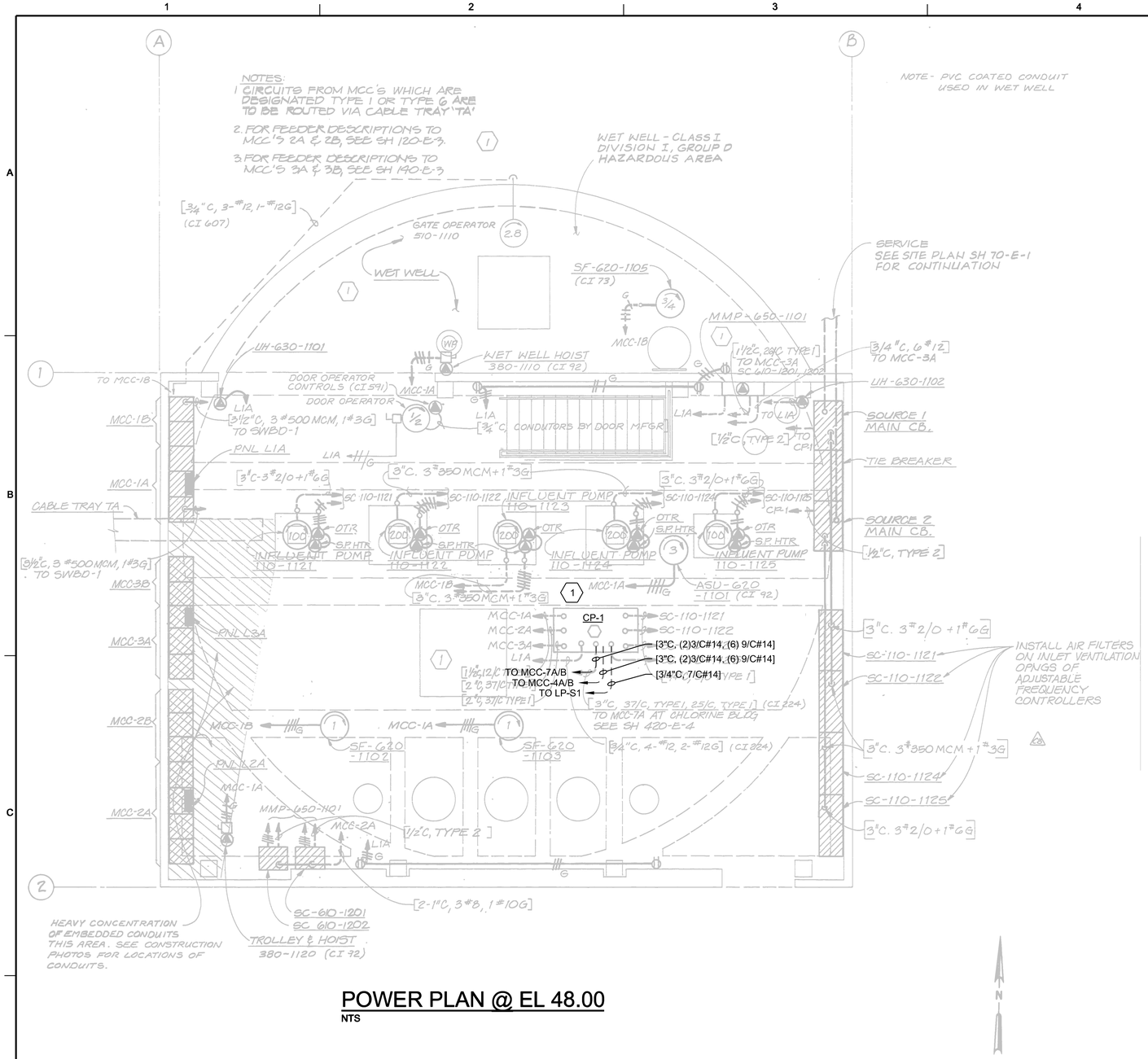
INSTRUMENTATION AND CONTROL
P&ID
210-LCP-2100
ALARM PANEL WIRING

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	100-N-62
SHEET	16 of 45



POWER PLAN @ EL 48.00

NTS

SHEET KEYNOTES

1. WIRE NEW CONDUIT AND CONDUCTORS TO PLC "CP-1" AS REQUIRED. SEE CONTROL DIAGRAMS 900-E-1 AND 900-E-3.

REGISTERED PROFESSIONAL ENGINEER — OREGON — 82012PE — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE	APVD	B FULLER	

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INFLUENT PUMP STATION
ELECTRICAL PLAN

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
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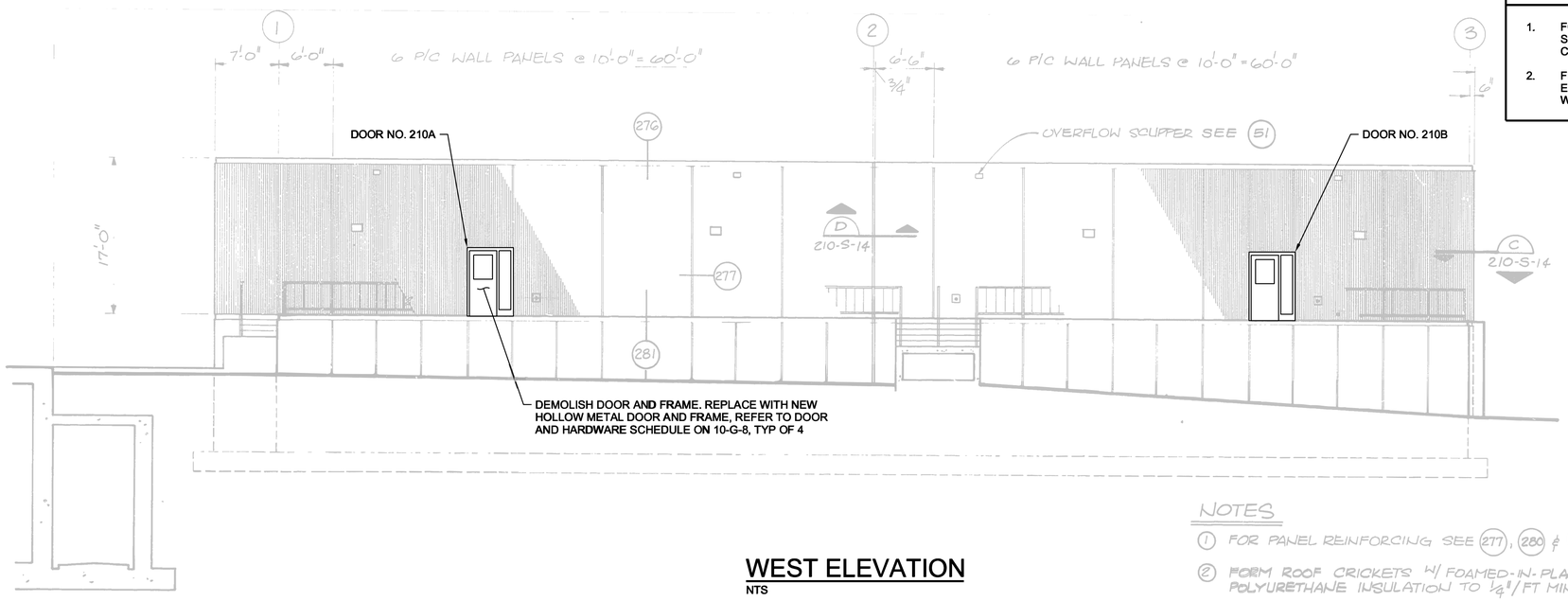
DATE	JUNE 2022
PROJ	692260
DWG	110-E-1
SHEET	17 of 45

GENERAL SHEET NOTES

1. FOR GENERAL ARCHITECTURAL NOTES, MATERIAL SYMBOLS, LEGEND, SCHEDULES AND BUILDING CODE DATA, SEE DRAWING 10-G-8.
2. FIELD VERIFY ALL DIMENSIONS THAT RELATE TO EXISTING WORK PRIOR TO COMMENCING NEW WORK.

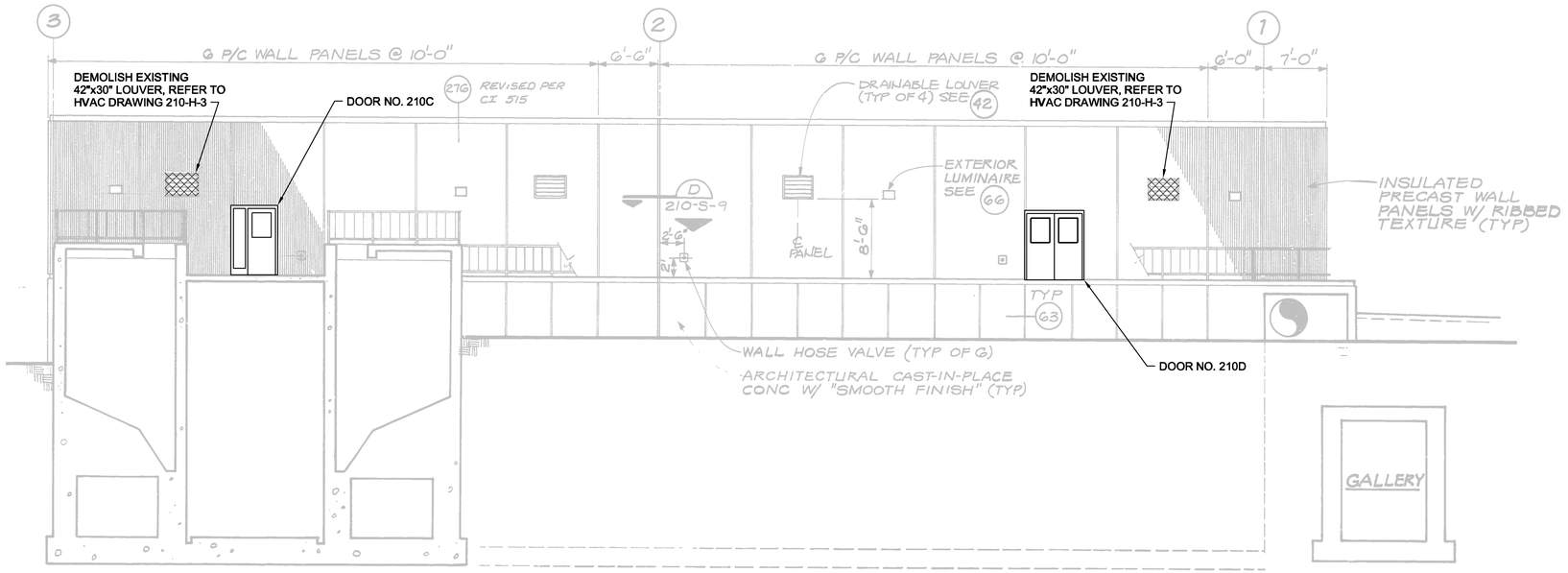


WEST ELEVATION

NTS

NOTES

1. FOR PANEL REINFORCING SEE (277), (280) & (281).
2. FORM ROOF CRICKETS W/ FOAMED-IN-PLACE POLYURETHANE INSULATION TO 1/4"/FT MIN SLOPE.



EAST ELEVATION

NTS

REGISTERED ARCHITECT — STATE OF OREGON — MARK SHARP — BELLEVUE, WASHINGTON — 13542 — 6/08/2022

NO.	DATE	REVISION	DR	CHK	BY
DSGN	E GRAY	S BRENNWALD		M SHARP	APVD
				APVD	B FULLER

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CONTRACT DOCUMENTS

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TRI-CITY SERVICE DISTRICT
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Jacobs

PRIMARY CLARIFIERS
ARCHITECTURAL ELEVATIONS

SCALE: AS SHOWN
VERIFY SCALE
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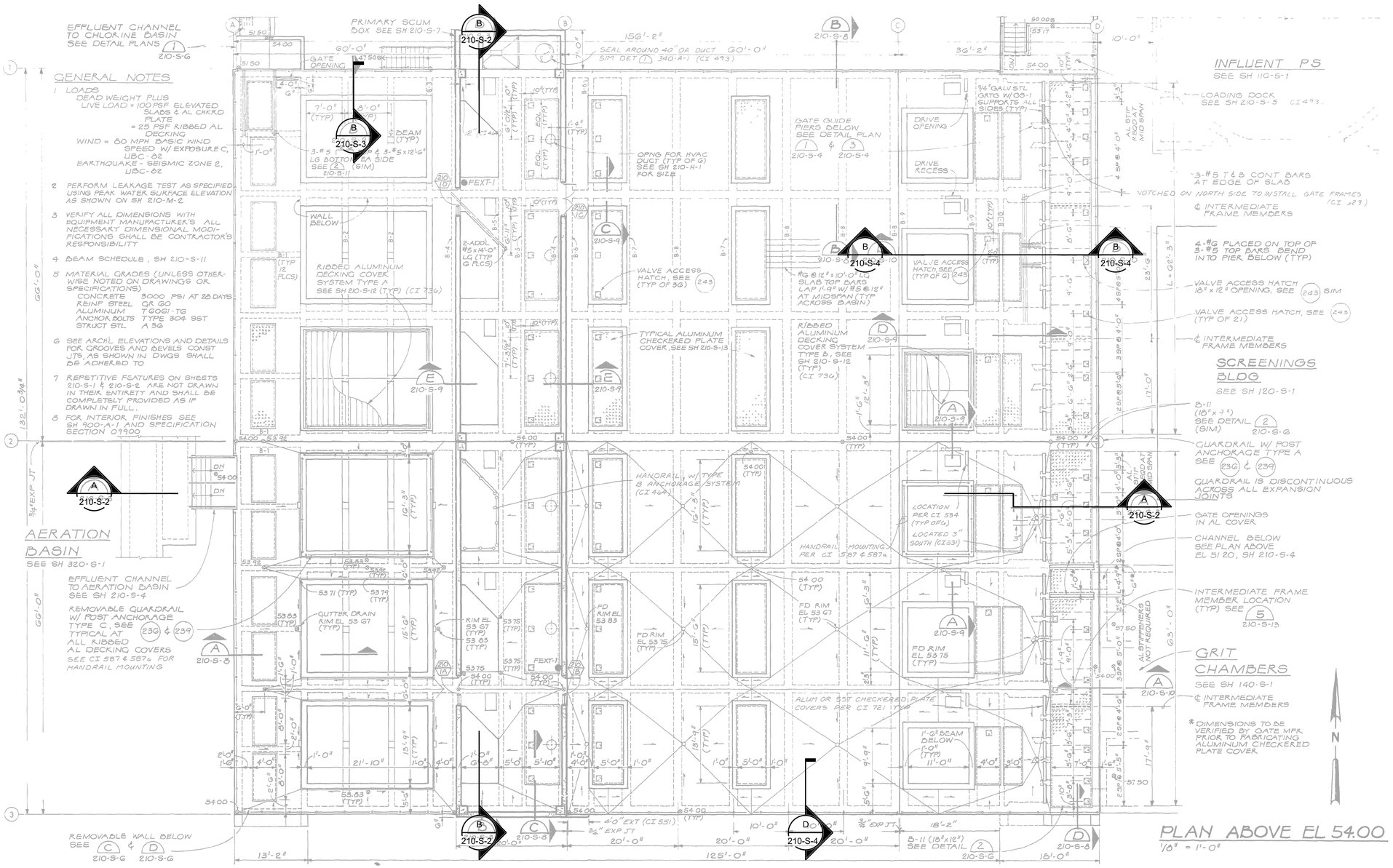
DATE	JUNE 2022
PROJ	692260
DWG	210-A-1
SHEET	18 of 45



REGISTERED PROFESSIONAL ENGINEER — STRUCTURAL — Digital Signature — OREGON — JULY 21, 1995 — ALEX L. FIRTH
EXP 12-31-23

NO.	DATE	REVISION	BY	APVD
DSGN	A FIRTH	DR H QUINNETT	CHK L KING	APVD B FULLER

CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

PRIMARY CLARIFIERS
STRUCTURAL PLAN

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
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DATE	JUNE 2022
PROJ	692260
DWG	210-S-1
SHEET	19 of 45

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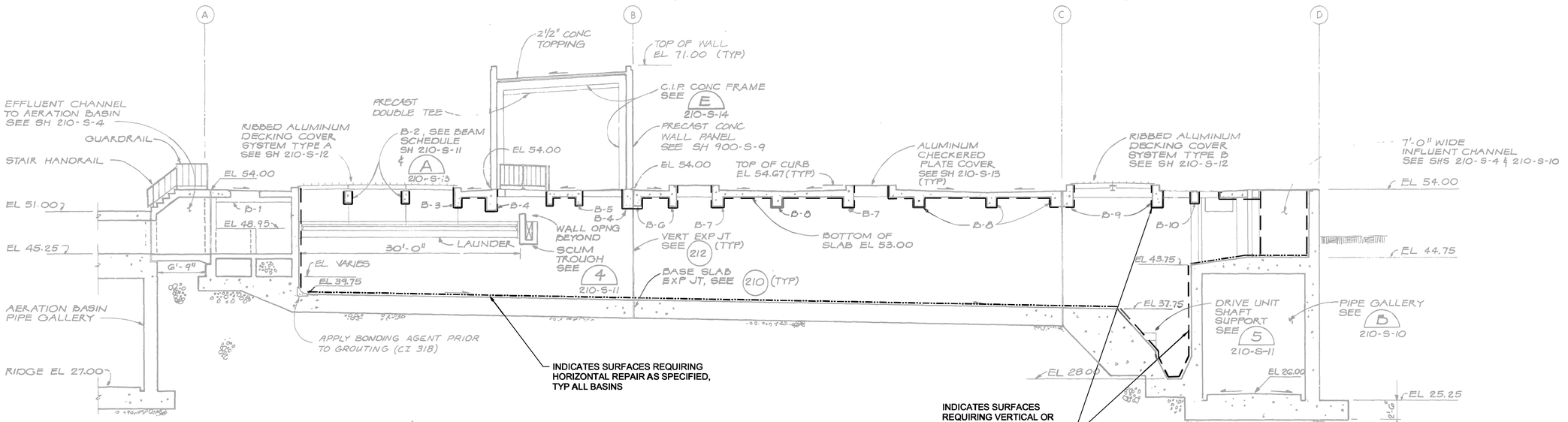
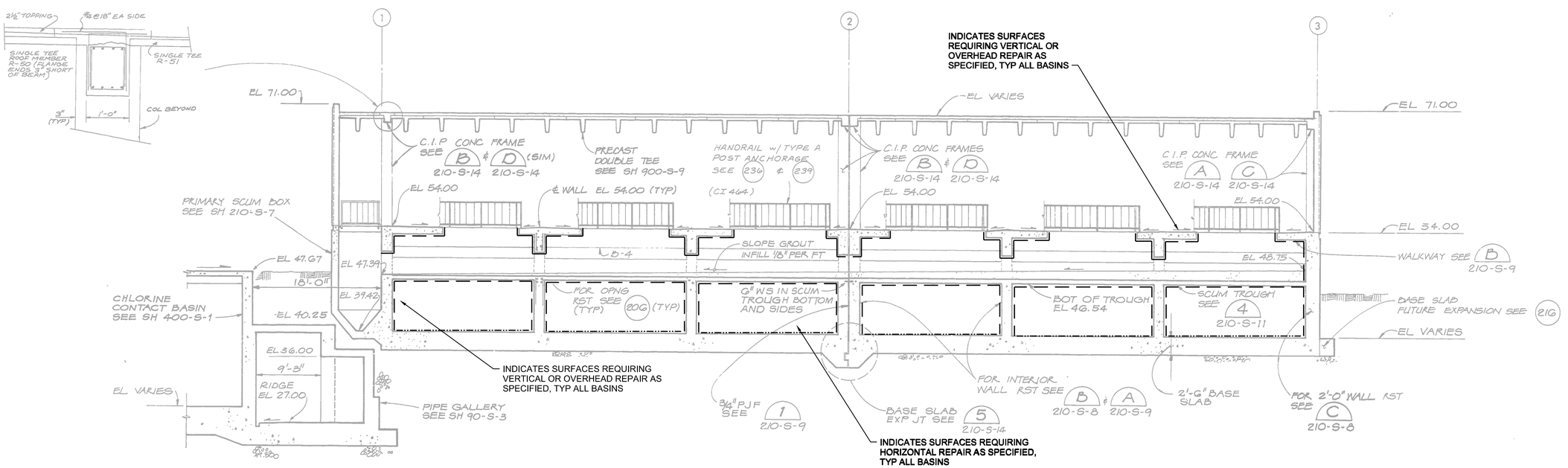


A SECTION
NTS
210-S-1



B SECTION
NTS
210-S-1

NOTES:

1. REFERENCE SECTIONS 03 01 32 AND 03 01 33 FOR CONCRETE RESURFACING REQUIREMENTS.
2. COORDINATE LOCATION AND INSTALLATION OF HEADSHAFT, IDLER STUB SHAFTS WITH SLUDGE COLLECTOR MECHANISM MANUFACTURER. OVERBUILD REPAIR MORTAR AT SHAFT MOUNT LOCATIONS AND GRIND TO TOLERANCE OF ±1/4.

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER OREGON
Digital Signature
JULY 21, 1995
ALEX L. FIRTH
EXP 12-31-23

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
	A FIRTH	H QUINNETT	L KING		B FULLER		

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

PRIMARY CLARIFIERS
STRUCTURAL SECTIONS

CONTRACT DOCUMENTS

SCALE: AS SHOWN	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	JUNE 2022
PROJ	692260
DWG	210-S-2
SHEET	20 of 45

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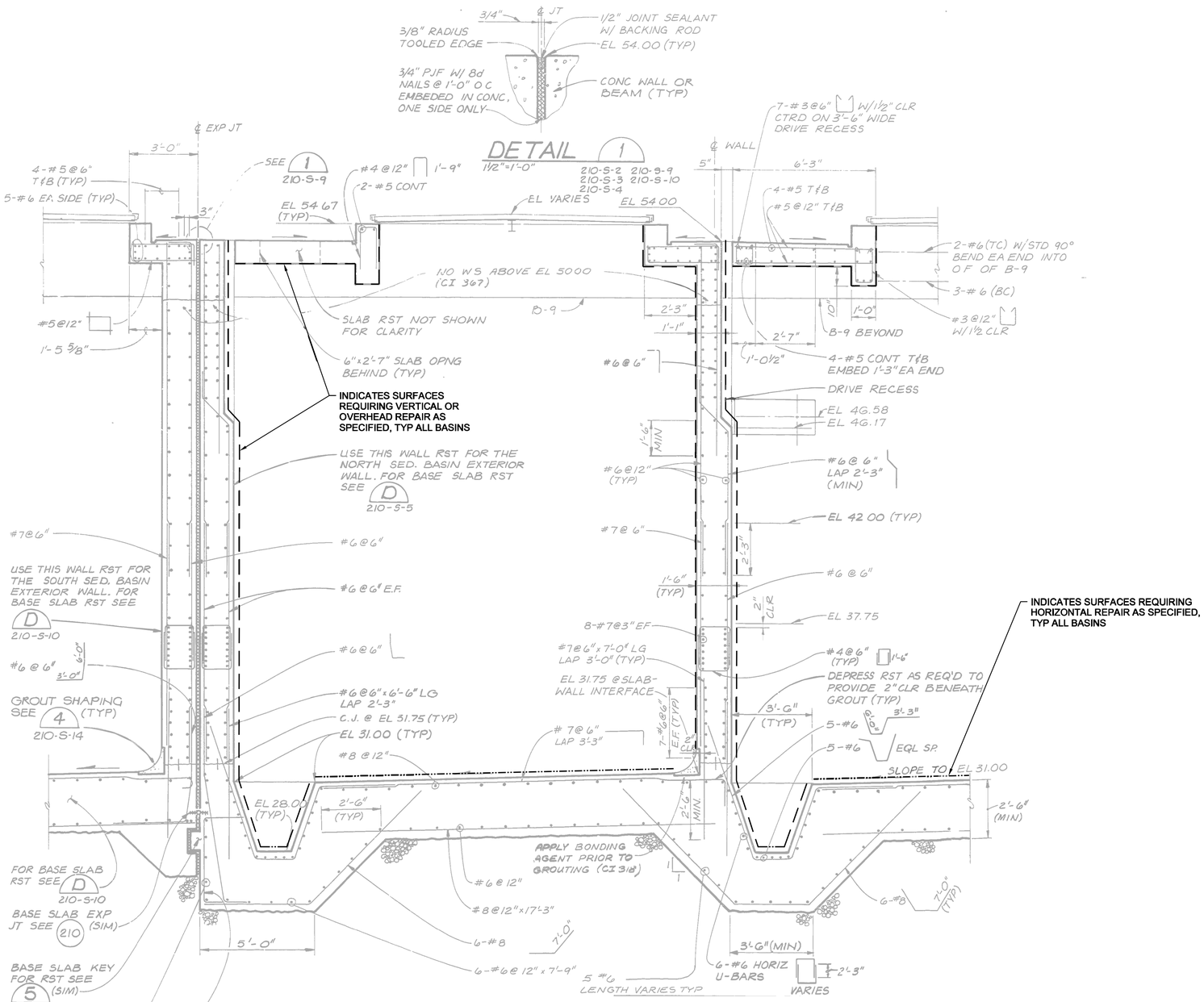
NOTES:

1. REFERENCE SECTIONS 03 01 32 AND 03 01 33 FOR CONCRETE RESURFACING REQUIREMENTS.
2. COORDINATE LOCATION AND INSTALLATION OF HEADSHAFT, IDLER STUB SHAFTS WITH SLUDGE COLLECTOR MECHANISM MANUFACTURER. OVERBUILD REPAIR MORTAR AT SHAFT MOUNT LOCATIONS AND GRIND TO TOLERANCE OF ±1/4.



A SECTION
NTS
210-S-1

STRUCTURAL REGISTERED PROFESSIONAL ENGINEER
Digital Signature
OREGON
JULY 21, 1995
ALEX L. FIRTH
EXP 12-31-23

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
	A FIRTH		H QUINNETT	L KING		B FULLER	

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

PRIMARY CLARIFIERS
STRUCTURAL SECTIONS

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
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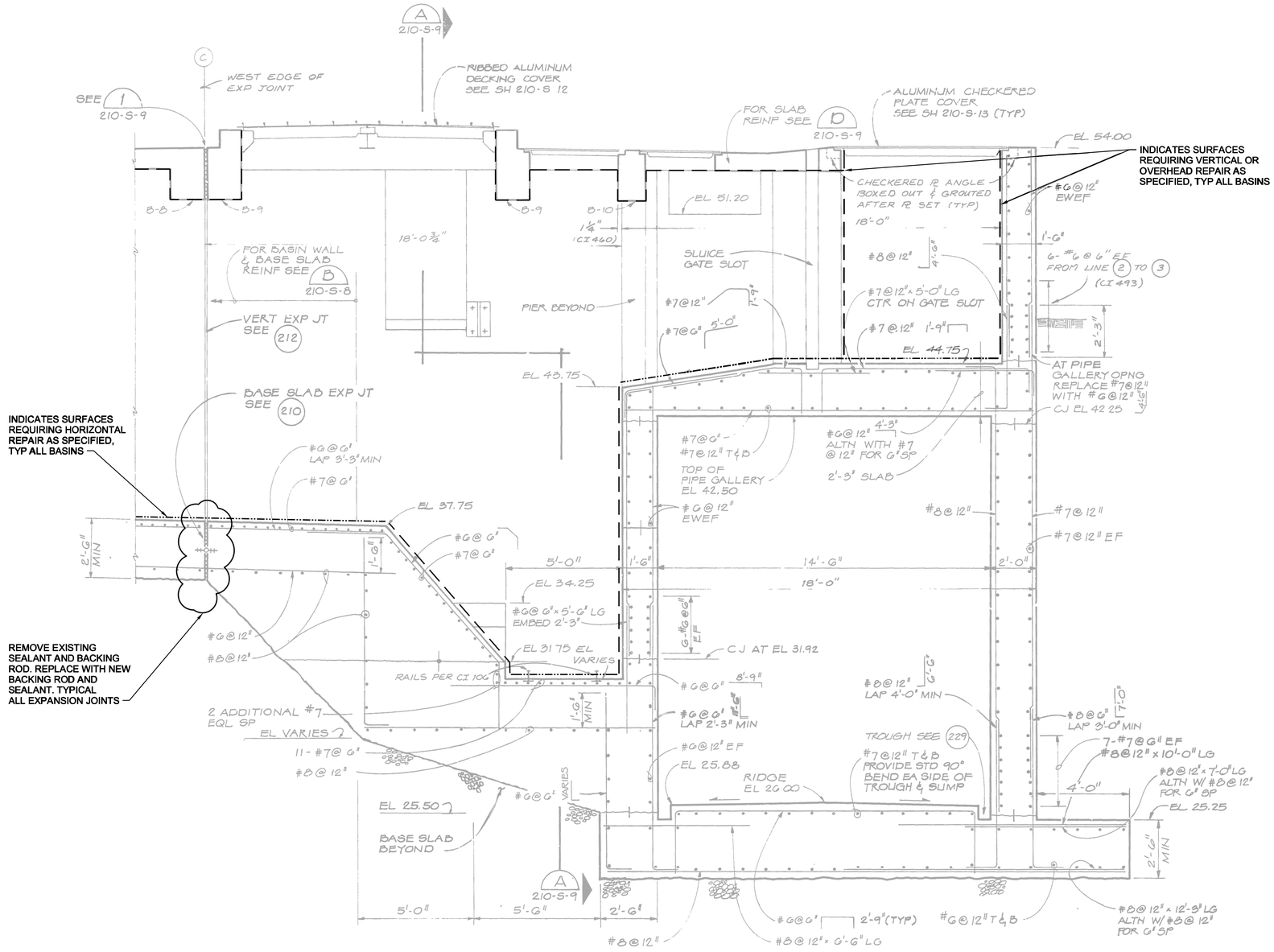
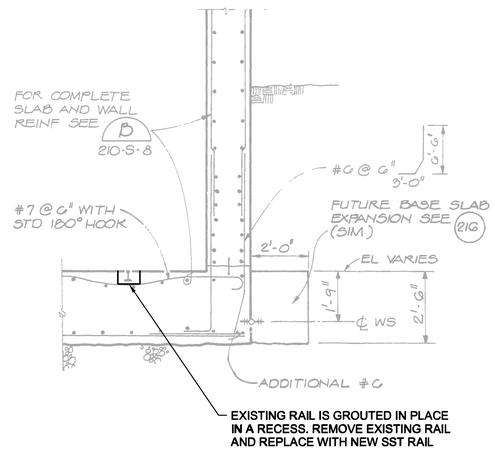
DATE	JUNE 2022
PROJ	692260
DWG	210-S-3
SHEET	21 of 45

NOTES:

1. REFERENCE SECTIONS 03 01 32 AND 03 01 33 FOR CONCRETE RESURFACING REQUIREMENTS.
2. COORDINATE LOCATION AND INSTALLATION OF HEADSHAFT, IDLER STUB SHAFTS WITH SLUDGE COLLECTOR MECHANISM MANUFACTURER. OVERBUILD REPAIR MORTAR AT SHAFT MOUNT LOCATIONS AND GRIND TO TOLERANCE OF ±1/4.



B SECTION
NTS
210-S-1



D SECTION
NTS
210-S-1

REGISTERED PROFESSIONAL ENGINEER — STRUCTURAL — 15,877PE — Digital Signature — OREGON — JULY 23, 1982 — ALEX L. FIRTH
EXP 12-31-23

NO.	DATE	DSGN	DR	CHK	APVD
		A FIRTH	H QUINNETT	L KING	B FULLER

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PRIMARY CLARIFIERS
STRUCTURAL SECTIONS

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DATE	JUNE 2022
PROJ	692260
DWG	210-S-4
SHEET	22 of 45

PRIMARY CLARIFIER BASIN DEMO PLAN

NTS

DEMOLISH SLUDGE COLLECTOR MECHANISM ASSEMBLIES, SCUM SKIMMER ASSEMBLY, APPURTENANCES, ELECTRICAL, AND CONTROL, TYP ALL BASINS (3 / 210-M-2A)

REMOVE, PROTECT, AND REINSTALL LAUNDERS FOR CONCRETE REPAIR WORK

CHIP OUT FLOOR RAILS AND REPAIR

DEMOLISH SCUM SKIMMER DRIVES, TYP OF 6 (1 / 210-M-2A)

DEMOLISH DRIVES, TYP ALL BASINS (2 / 210-M-2A)

PHASE 1, SEE NOTE 2

PHASE 2

PHASE 3

NOTES:

1. WORK FOR ALL SIX PRIMARY SEDIMENTATION BASINS ARE SIMILAR. BASIN 1-3 SHOWN WITHOUT COVER, BASIN 4-6 SHOWN WITHOUT HELICAL SCUM SKIMMERS AND SLUDGE COLLECTOR MECHANISMS.
2. SEQUENCING CONSTRAINTS APPLY. SEE SECTION 01 31 13 - PROJECT COORDINATION.
3. DEMOLITION OF PIPING INCLUDES ALL APPURTENANCES, SUPPORTS, AND ANCHOR BOLTS. ANCHOR BOLTS ARE TO BE REMOVED MINIMUM 1" BELOW THE SURFACE OF THE CONCRETE. REPAIR CONCRETE PER SECTION 03 01 32 AND 03 01 33.

REGISTERED PROFESSIONAL ENGINEER — Digital Signature — OREGON — 17689PE — NATHAN JAMES EBBS — EXP. 12-31-23

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NO.	DATE	REVISION	BY	APVD
DSGN	S BAAR	DR S BRENNWALD	CHK	APVD N EBBS

B FULLER

CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

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PRIMARY CLARIFIERS
PROCESS MECHANICAL DEMOLITION PLAN

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CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
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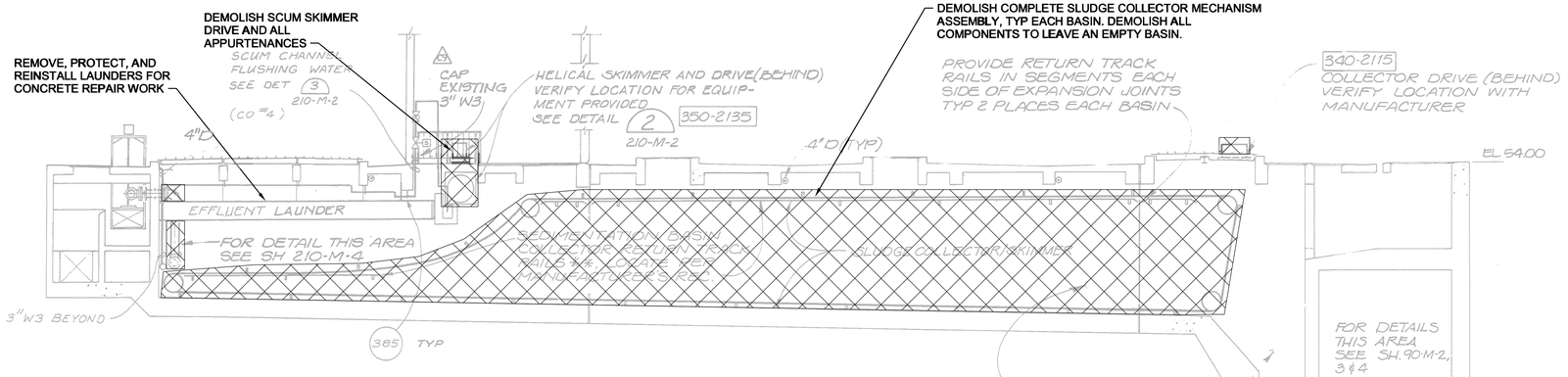
DATE	JUNE 2022
PROJ	692260
DWG	210-M-1
SHEET	23 of 45

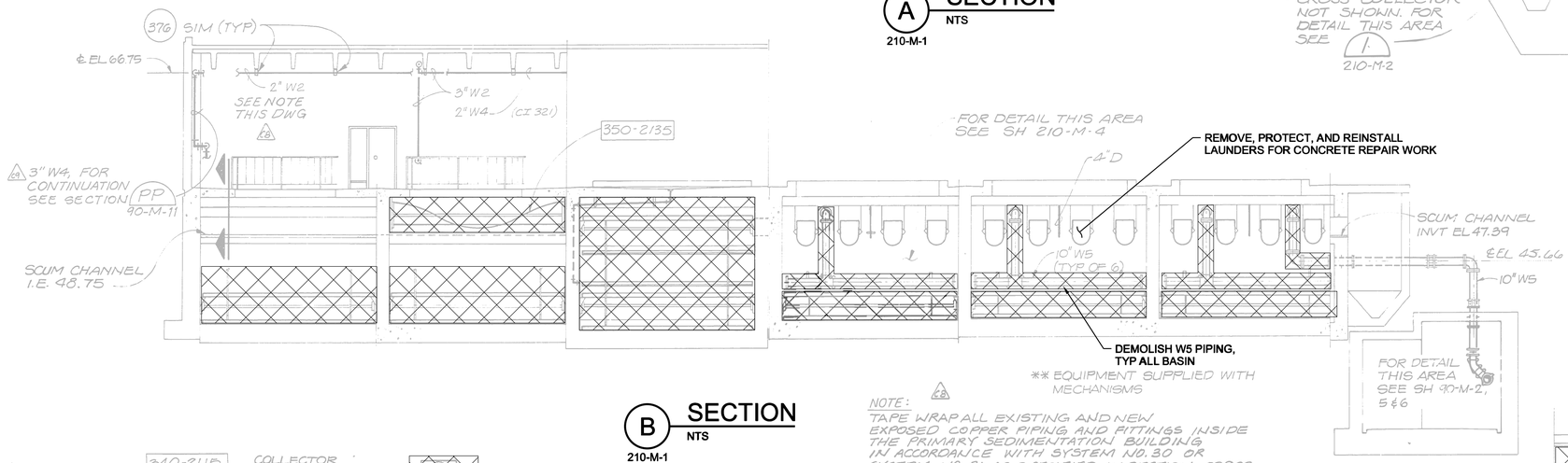
$PWURL $PWPATH FILENAME: 210-M-1_692260.dgn PLOT DATE: 2022\06\03 PLOT TIME: 12:53:22 PM

NOTE:

1. WORK FOR ALL SIX PRIMARY CLARIFIER BASINS IS SIMILAR.

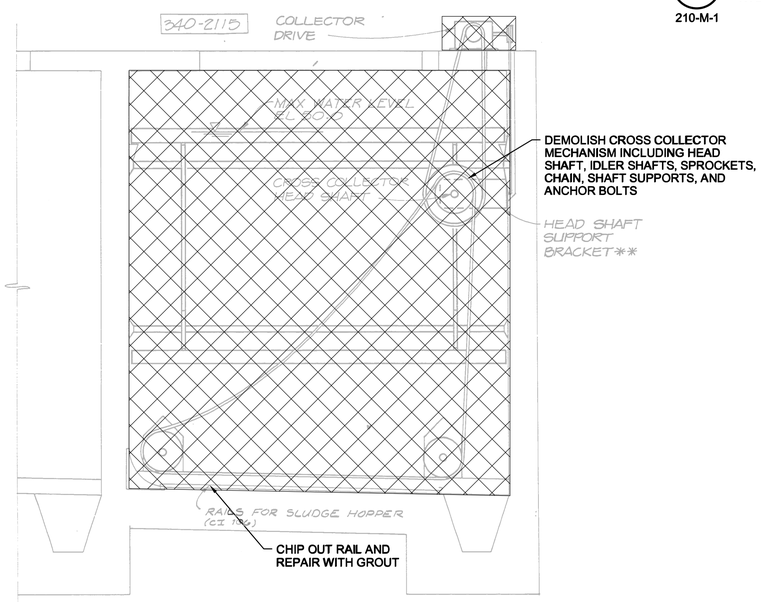


A SECTION
NTS
210-M-1

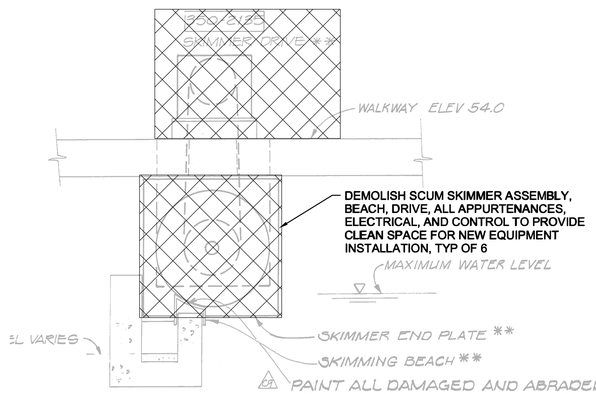


B SECTION
NTS
210-M-1

NOTE:
TAPE WRAP ALL EXISTING AND NEW EXPOSED COPPER PIPING AND FITTINGS INSIDE THE PRIMARY SEDIMENTATION BUILDING IN ACCORDANCE WITH SYSTEM NO. 30 OR SYSTEM NO. 31 AS SPECIFIED IN SECTION 09900.

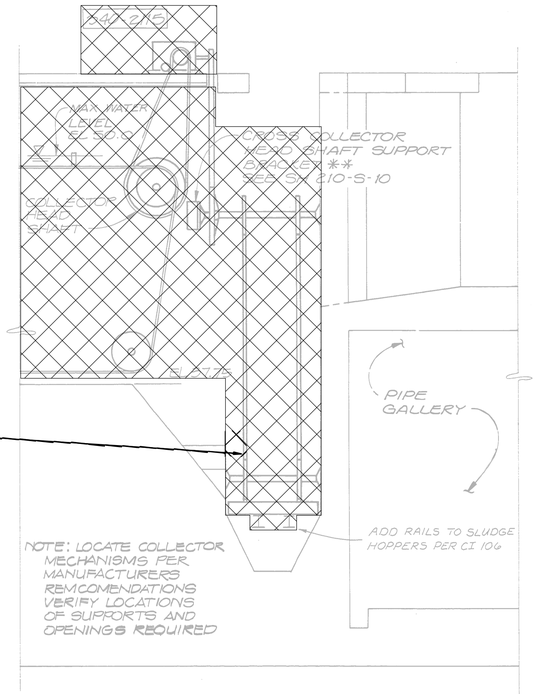


C SECTION
NTS
210-M-1



2 DETAIL
NTS
210-M-1

DEMOLISH COMPLETE CROSS COLLECTOR MECHANISM ASSEMBLY, TYP EACH BASIN. DEMOLISH ALL COMPONENTS TO LEAVE AN EMPTY BASIN. CUT ANCHORS 1" DEEP AND PATCH PER 0330-143
4
210-M-2A



1 DETAIL
NTS
210-M-1

REGISTERED PROFESSIONAL ENGINEER — OREGON — 77689PE — Digital Signature — NATHAN JAMES — FEBBS — 08 x 11, 2020
EXP. 12-31-23

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DSGN	S BAAR	S BRENNWALD		N EBBS	APVD	B FULLER

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TRI-CITY SERVICE DISTRICT
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WATER RESOURCE RECOVERY FACILITY

Jacobs

PRIMARY CLARIFIERS

PROCESS MECHANICAL DEMOLITION SECTIONS

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	210-M-2
SHEET	24 of 45

$PWURL $PWPATH FILENAME: 210-M-2_692260.dgn PLOT DATE: 2022\06\03 PLOT TIME: 12:51:02 PM

1 SCUM SKIMMER DRIVE DEMO
NTS

NOTES:

1. DEMOLISH SCUM DRIVE, ELECTRICAL CONNECTION, AND ALL APPURTANCES.
2. DEMOLISH EQUIPMENT PAD (0330-143)
3. TYPICAL ALL BASINS

2 SLUDGE COLLECTOR DRIVE DEMO
NTS

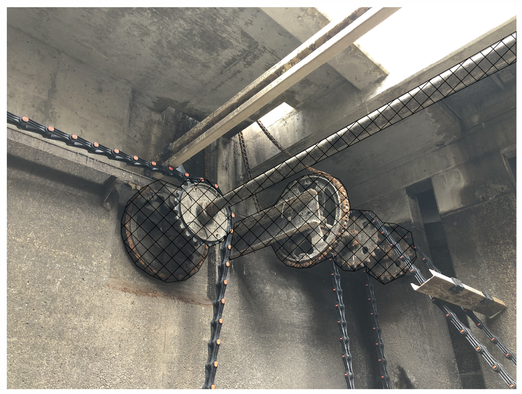
NOTES:

1. DEMOLISH COLLECTOR DRIVE, ELECTRICAL CONNECTION, AND ALL APPURTANCES.
2. DEMOLISH EQUIPMENT PAD (0330-143)
3. TYPICAL ALL BASINS

3 SCUM SKIMMER AND SLUDGE COLLECTOR MECHANISM DEMO
NTS

NOTES:

1. TYPICAL ALL BASINS
2. DEMOLISH SCUM SCKIMMER
3. DEMOLISH SCUM BEACH
4. DEMOLISH IDLER SHAFT, TYP 3 PER BASIN
5. DEMOLISH CLARFIER MECHANISM
6. DEMOLISH WEAR STRIPS, RAILS, AND WALL BRACKETS



4 SLUDGE COLLECTOR MECHANISM DEMO
NTS

NOTE:

1. DEMOLISH HEAD SHAFT FOR LONG AND CROSS COLLECTOR, BEARINGS, AND SUPPORTS

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PROCESS MECHANICAL
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PRIMARY CLARIFIER BASIN DEMO PLAN

NTS

INSTALL NEW SLUDGE COLLECTOR MECHANISM PACKAGE ASSEMBLY PER MFR SHOP DRAWINGS AND RECOMMENDATIONS, TYP ALL BASINS

INSTALL NEW SLUDGE COLLECTOR FLOOR RAILS AND COLLECTOR RETURN RAILS, TYP ALL BASINS

INSTALL NEW FLOOR RAILS IN HOPPER, TYP ALL

SEE ENLARGED PLAN

INSTALL TWO NEW LAUNDERS PER BASIN. SEE NOTE 4

INSTALL NEW HELICAL SCUM SKIMMER PACKAGE PER MFR SHOP DRAWINGS AND RECOMMENDATIONS, TYP ALL BASINS

ROTATING SCUM SKIMMER DRIVE, TYP OF 6

REPLACE 2" DRAIN PIPING FROM ROOF DRAIN. TERMINATE WITH DISCHARGE INTO BASINS 6" BELOW MINIMUM LIQUID SURFACE, TYP OF 4

POSSIBLE BULKHEAD LOCATIONS FOR WORK SEQUENCING. SEE NOTE 2. TYP OF 2

PHASE 1, SEE NOTE 2

PHASE 2

PHASE 3

LONGITUDINAL AND CROSS COLLECTOR DRIVES, TYP ALL BASINS

LOCATE NEW COLLECTOR DRIVES TO REUSE EXISTING DECK OPENINGS FOR THE CHAIN DRIVE.

REPLACE 84" x 93" FRP DISC PLATE FOR GATES

NOTES:

1. WORK FOR ALL SIX PRIMARY SEDIMENTATION BASINS ARE SIMILAR. BASIN 1-3 SHOWN WITHOUT COVER SYSTEM, BASIN 4-6 SHOWN WITHOUT SKIMMER AND COLLECTION EQUIPMENT.
2. SEQUENCING CONSTRAINTS APPLY. SEE SECTION 01 31 13 - PROJECT COORDINATION AND 35 16 20.25 - FABRICATED SLIDE GATES. DISASSEMBLE GATE OPERATOR, FRAME, AND STEM. PROTECT AND REINSTALL EXISTING GATE OPERATOR, FRAME AND STEM WITH NEW DISC PLATE. SET GATE SEAL STRIPS PER MANUFACTURER RECOMMENDATIONS.
3. APPROXIMATE LOCATIONS SHOWN FOR PRIMARY CLARIFIER MECHANISM. LOCATE AND INSTALL EQUIPMENT PER MANUFACTURER SHOP DRAWINGS.
4. FOR BASE BID PURPOSES, PROVIDE TWO NEW LAUNDERS PER BASIN. OWNER TO DETERMINE WHICH TWO LAUNDERS TO BE RE-USED AND RE-INSTALLED AND WHICH TWO LAUNDERS TO BE REPLACED BY THE NEW LAUNDERS FOLLOWING BASIN INSPECTION.

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PRIMARY CLARIFIERS
PROCESS MECHANICAL PLAN

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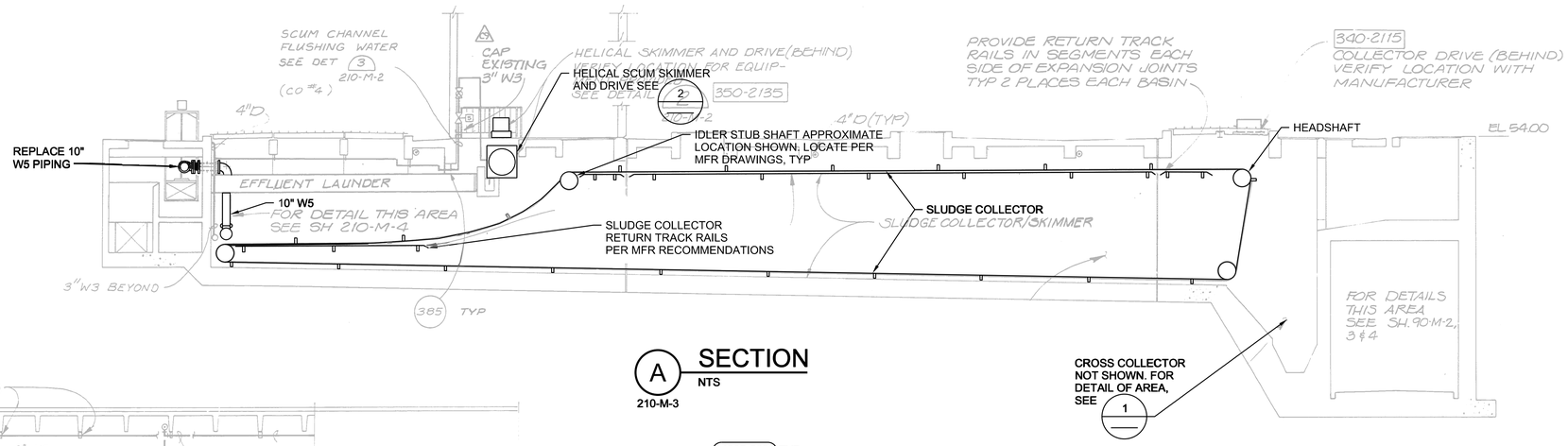
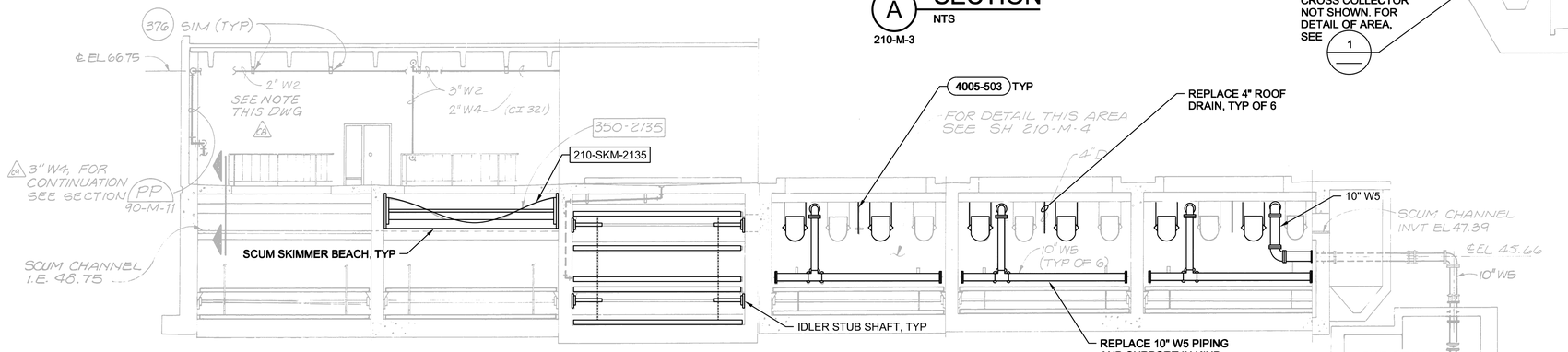
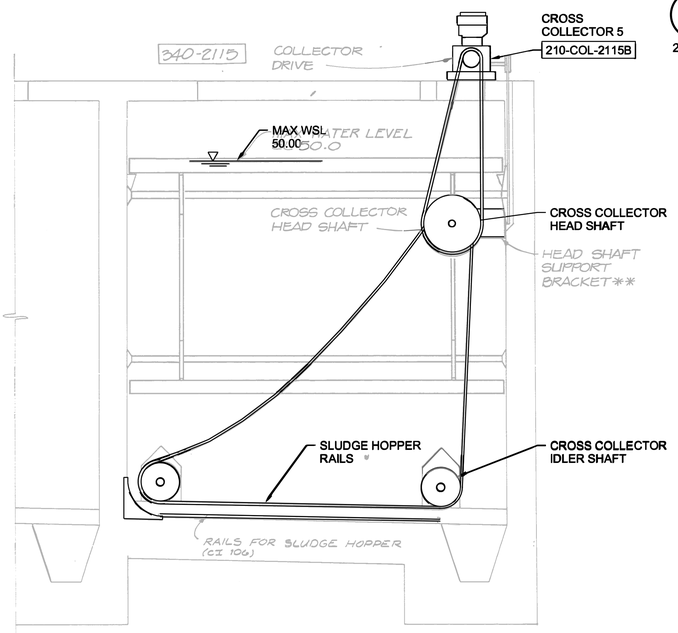


A SECTION
NTS
210-M-3



B SECTION
NTS
210-M-3

NOTE: TAPE WRAP ALL EXISTING AND NEW EXPOSED COPPER PIPING AND FITTINGS INSIDE THE PRIMARY SEDIMENTATION BUILDING IN ACCORDANCE WITH SYSTEM NO. 30 OR SYSTEM NO. 31 AS SPECIFIED IN SECTION 09900.



C SECTION
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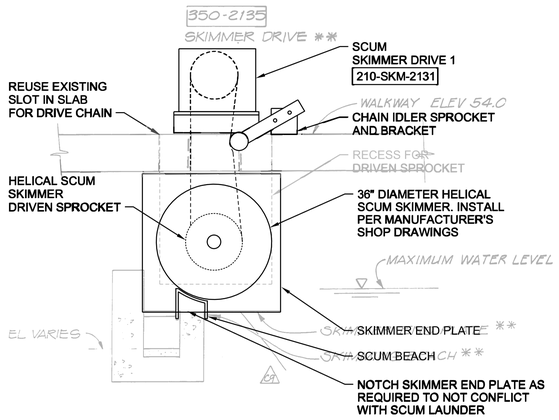
210-M-3



2 DETAIL
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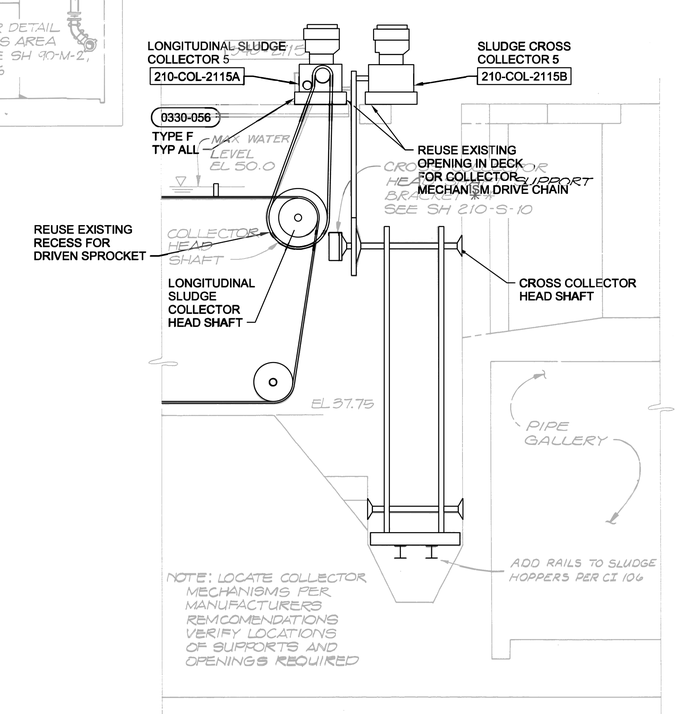

1 DETAIL
NTS
210-M-3

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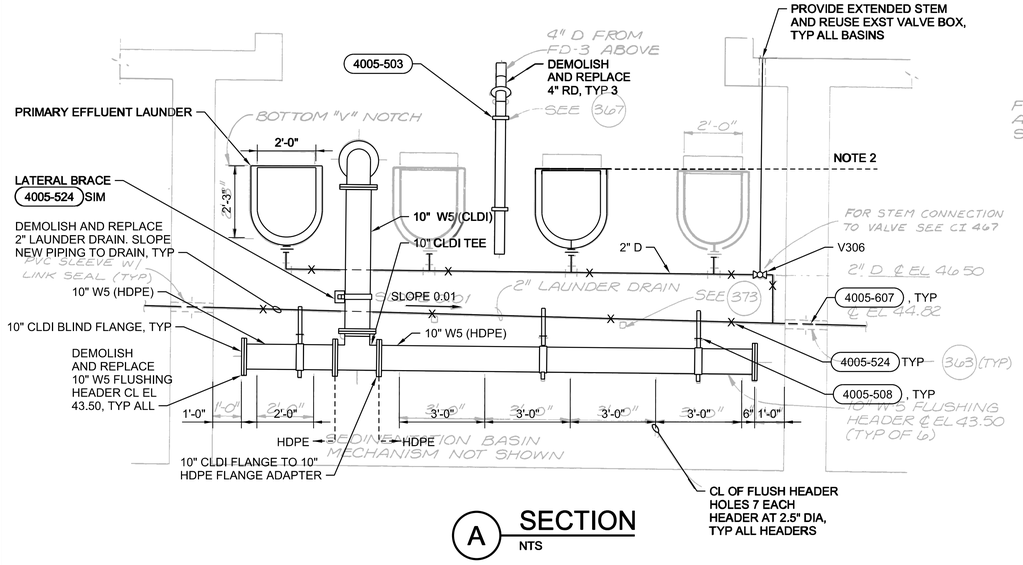
SHEET	27 of 45

NOTES:

1. PRESSURE TEST W5 PIPING PRIOR TO DRILLING HOLES IN HDPE.
2. CONTRACTOR TO MEASURE WEIR ELEVATIONS AT EACH PRIMARY EFFLUENT LAUNDER AND RECORD ON AS-BUILT DRAWINGS.
3. PREPARE SURFACE AND COAT WITH SYSTEM NO. 2, IN ACCORDANCE WITH 09 900 00, PAINTING AND COATING.



A SECTION
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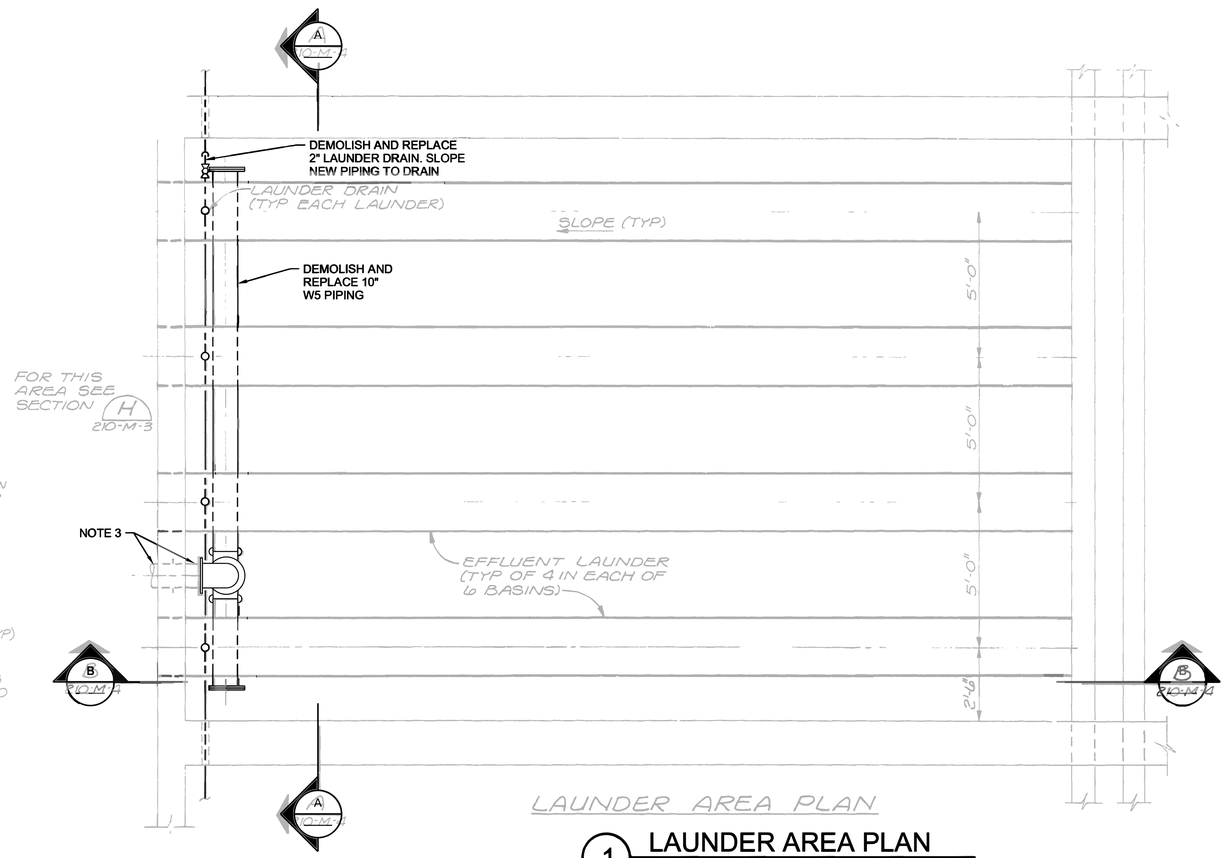
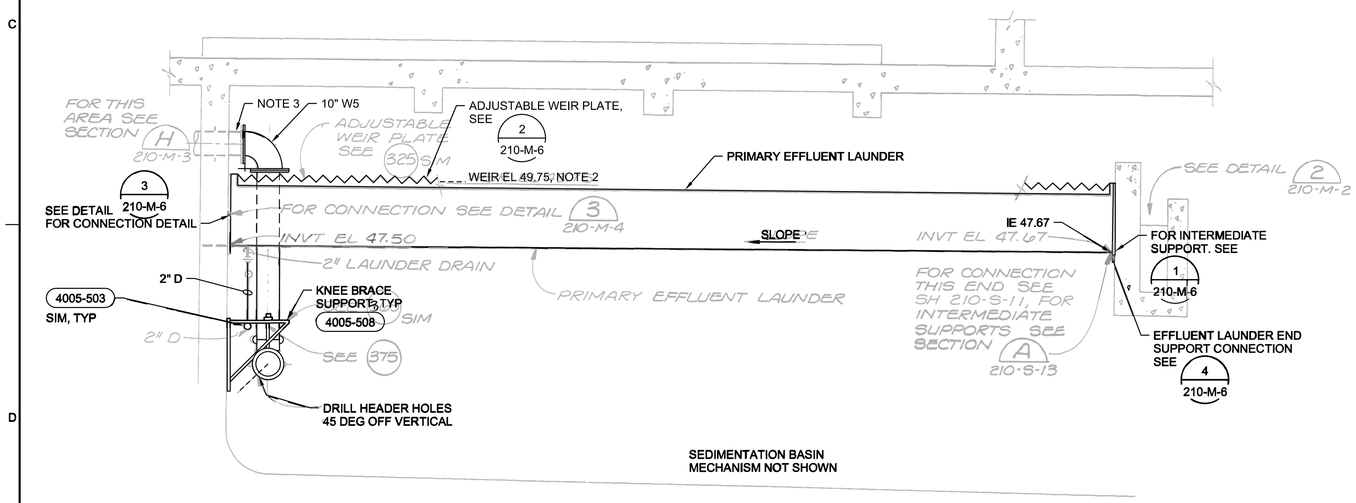


1 LAUNDER AREA PLAN
NTS
210-M-3



B SECTION
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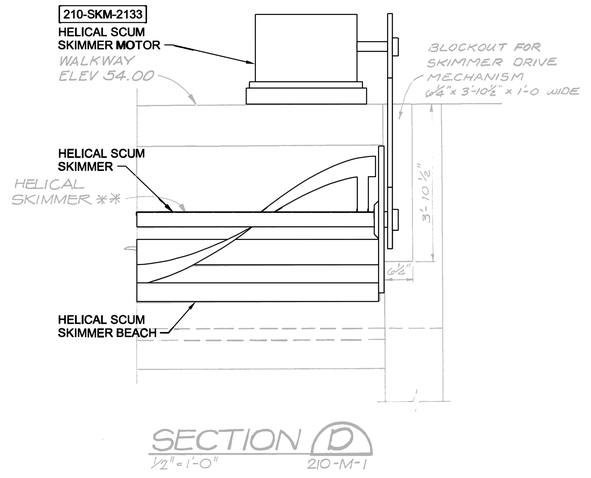

D HELICAL SCUM SKIMMER
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REGISTERED PROFESSIONAL ENGINEER
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OREGON
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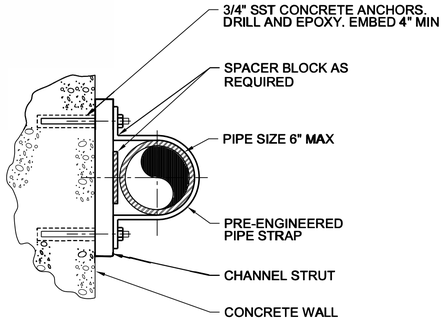
SHEET	28 of 45

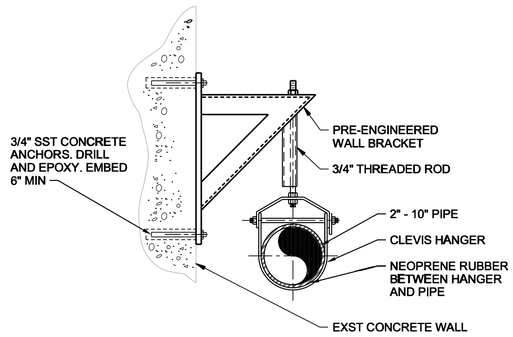


NOTES:

1. ONLY FOR VERTICAL PIPES.
2. NOT FOR USE ON CEILINGS OR BOTTOMS OF BEAMS.
3. PROVIDE PIPE PROTECTION BARRIER AS SPECIFIED. FABRICATE OVERSIZE STRAP WHERE REQUIRED.

PIPE SUPPORT - WALL MOUNT

4005-503

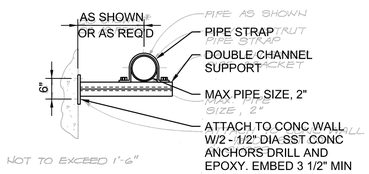


NOTE:

1. WALL BRACKET SHALL BE HEAVY DUTY

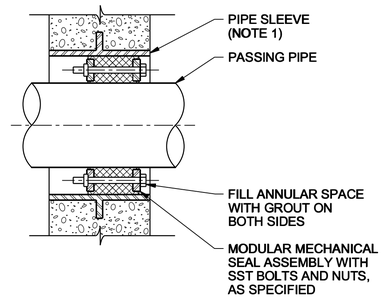
PIPE SUPPORT - WALL MOUNTED MEDIUM

4005-508



PIPE WALL SUPPORT

4005-524



NOTES:

1. FOR EXISTING WALLS, CORE-DRILL WALL AND OMIT SLEEVE.

WALL PIPE PENETRATION SEAL

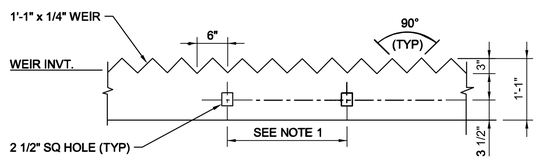
4027-607

NOTE:

1. MATCH EXISTING

1 EFFLUENT LAUNDER SUPPORT

NTS

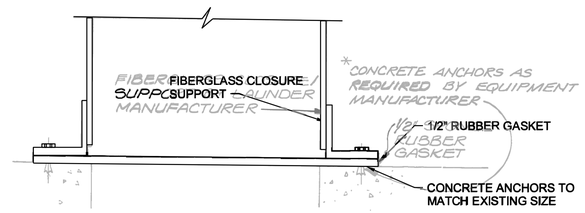


NOTES:

1. SCUM BAFFLE ANCHORS SHALL BE EQUALLY SPACED AT 4'-0" O.C. MAX. PLACE WEIR ANCHORS AT 2'-0" O.C. MAX OR AS RECOMMENDED BY MFR
2. ALL PARTS EXCEPT FASTENERS SHALL BE FIBERGLASS.

2 TYPICAL "V" NOTCH WEIR ASSEMBLY

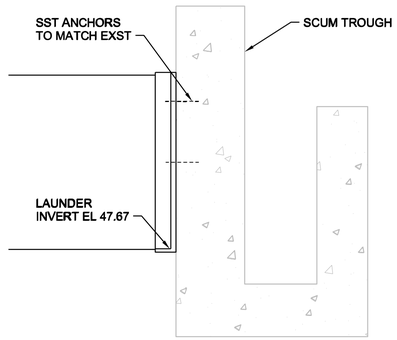
NTS



3 CONNECTION DETAIL

NTS

* SST WEDGE ANCHORS FOR ATTACHING FIBERGLASS (CR 37)



4 EFFLUENT LAUNDER END SUPPORT CONNECTION

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PRIMARY CLARIFIERS
PROCESS MECHANICAL DETAILS

CONTRACT DOCUMENTS

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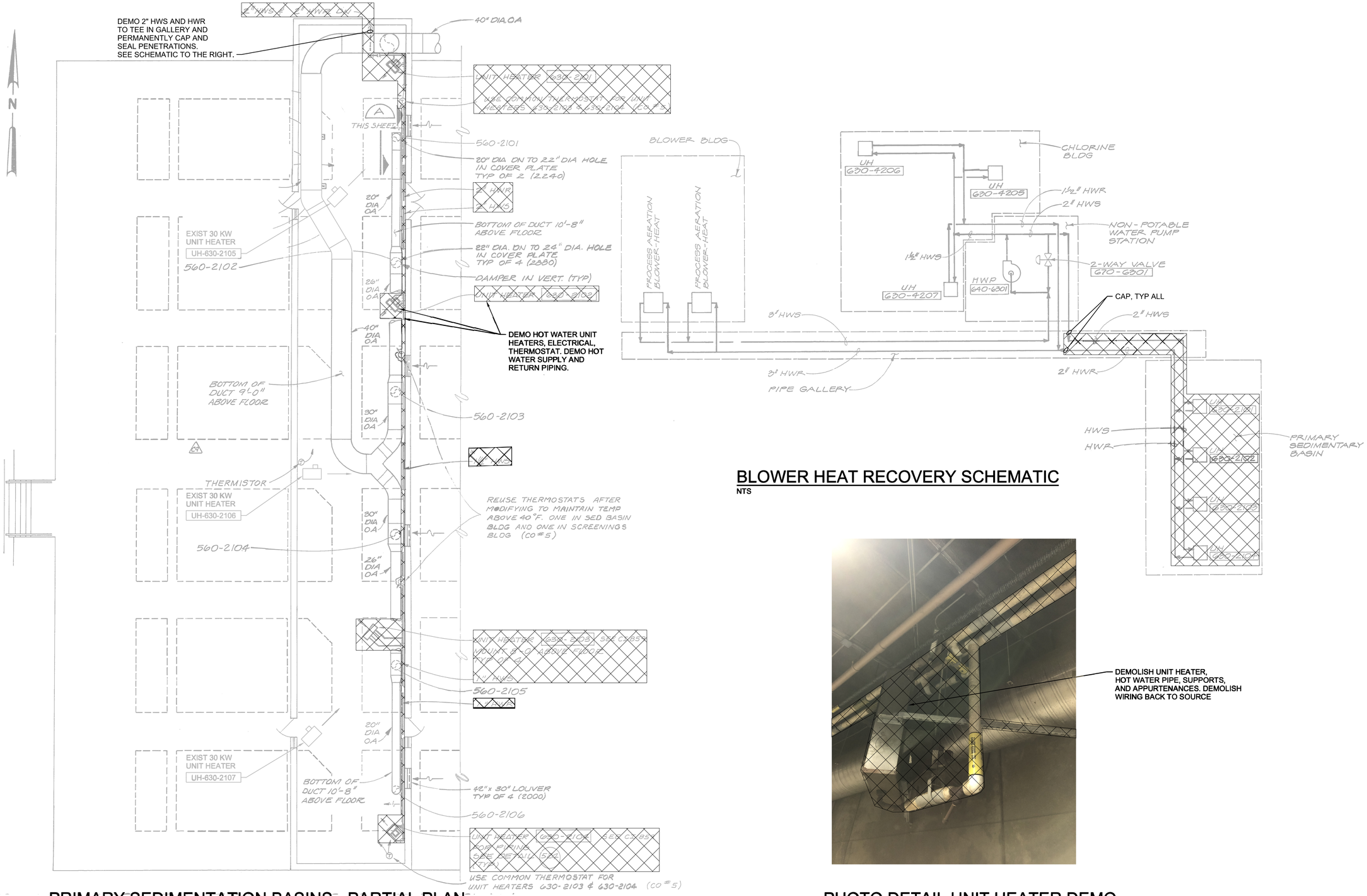

PRIMARY SEDIMENTATION BASINS - PARTIAL PLAN

NTS

BLOWER HEAT RECOVERY SCHEMATIC

NTS

DEMOLISH UNIT HEATER, HOT WATER PIPE, SUPPORTS, AND APPURTENANCES. DEMOLISH WIRING BACK TO SOURCE

PHOTO DETAIL UNIT HEATER DEMO

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REGISTERED PROFESSIONAL ENGINEER 14586 OREGON — Digital Signature — JULY 26, 2022 — JAMES H. SACKINGER — EXP. 06-30-22

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PRIMARY CLARIFIERS
HVAC DEMOLITION PLAN

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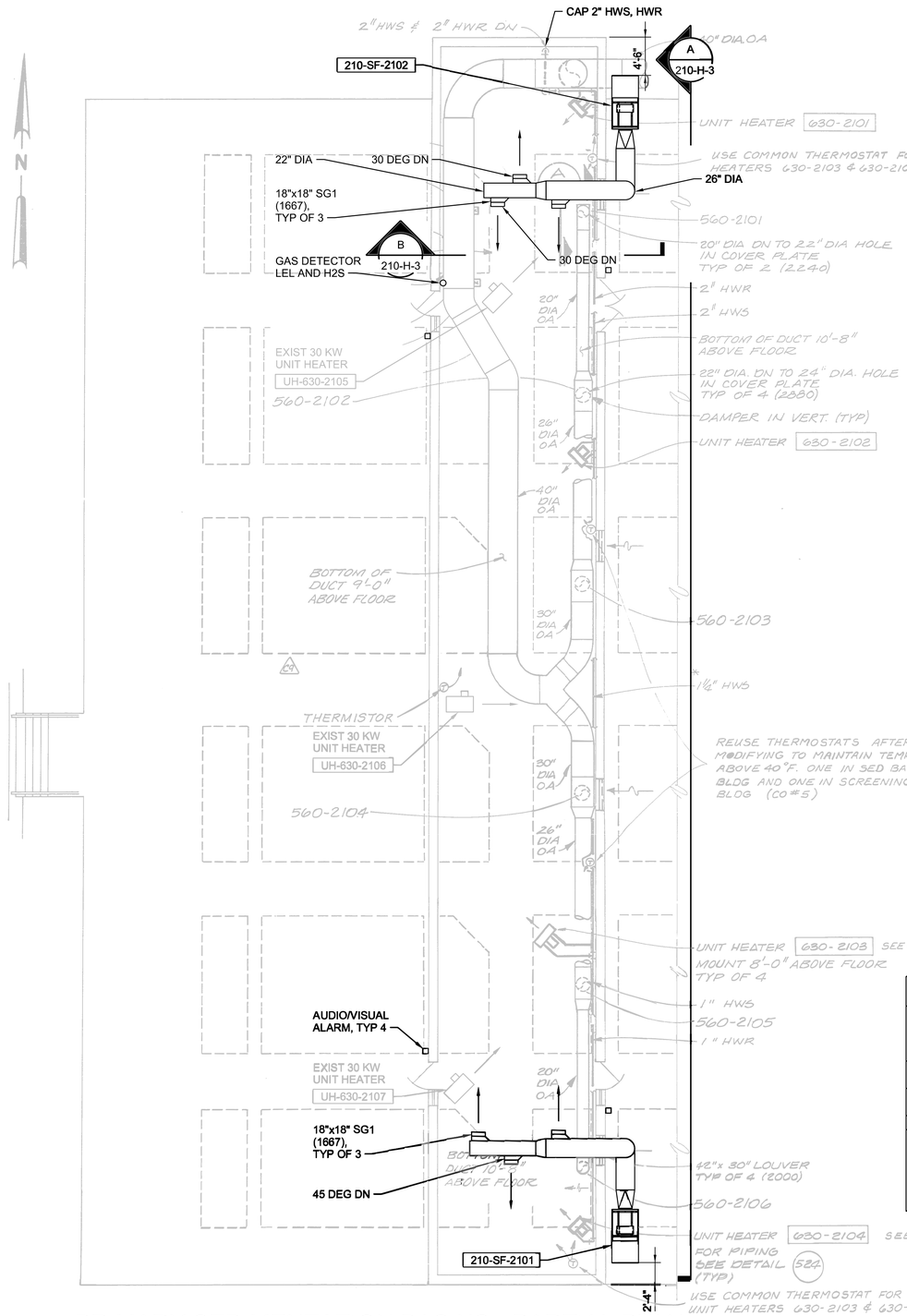
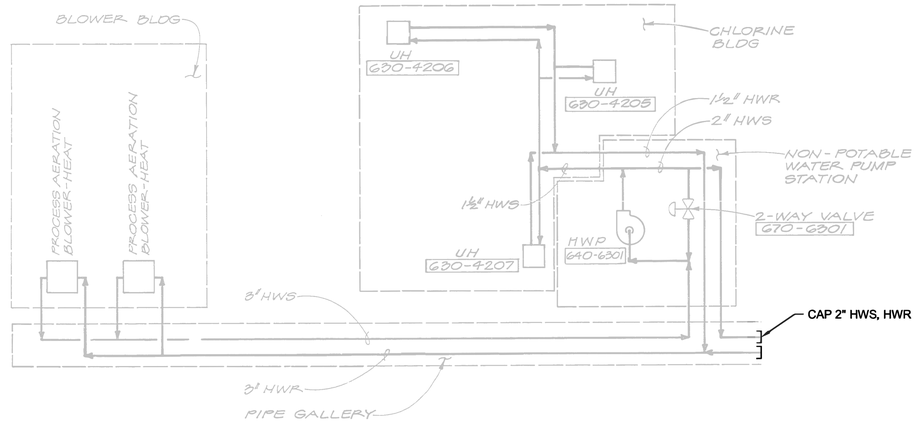
SHEET	30 of 45



PRIMARY SEDIMENTATION BASINS - PARTIAL PLAN

NTS



BLOWER HEAT RECOVERY SCHEMATIC

NTS

FANS - FACILITY 210

23 34 00.02

SYMBOL	SERVICE	LOCATION	TYPE	FAN DATA						PHYSICAL		ELECTRICAL DATA			MANUFACTURER AND MODEL NO.
				AIRFLOW		SPEED	DRIVE	WHEEL /BLADE	MAXIMUM	OVERALL		MOTOR			
				CFM	@ ESP IN. WG.	RPM	TYPE	TYPE	BHP	DIMENSIONS L x W x H	WEIGHT POUNDS	HP	ENCL OSURE	VOLT /PHASE	
210-SF-2101	PRIMARY CLARIFIER	210 ROOF DECK	CENTRIFUGAL SUPPLY FAN-FILTER	5,000	0.4	672	BELT	FC	1.68	82"x40"x46"	1250	2	TEFC	460/3	GREENHECK KSFB-115-H25-01
210-SF-2102	PRIMARY CLARIFIER	210 ROOF DECK	CENTRIFUGAL SUPPLY FAN-FILTER	5,000	0.4	672	BELT	FC	1.68	82"x40"x46"	1250	2	TEFC	460/3	GREENHECK KSFB-115-H25-01

APPLICABLE REMARKS:
- A: CUSTOM CURB, 30" TALL, CORROSION RESISTANT
- B: CONTINUOUS DUTY W/ ALARM TO PLC ON FAILURE
- C: FRONT HORIZONTAL DISCHARGE, REAR INLET
- D: CORROSION RESISTANT COATING, ASTM B117 RATING 2500 HOUR
- E: CORROSION RESISTANT FASTENERS
- F: 1" WASHABLE ALUMINUM MESH FILTERS IN WEATHER HOOD.
- G: INITIAL FILTER PRESSURE DROP 0.104 IN. W.C.
- H: STARTERS AND DISCONNECTS BY ELECTRICAL

ABBREVIATIONS:
- FC: FORWARD CURVED
- ESP: STATIC PRESSURE EXTERNAL TO FAN AND FILTER
- IN.WG.: INCHES WATER GAUGE

REGISTERED PROFESSIONAL ENGINEER — OREGON — JULY 26, 2005 — JAMES H. SACKINGER — EXP. 06-30-22

Digital Signature

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NO.	DATE	REVISION	BY	APVD
DSGN	S BAAR	DR R CARMONA	CHK J SACKINGER	APVD B FULLER

CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

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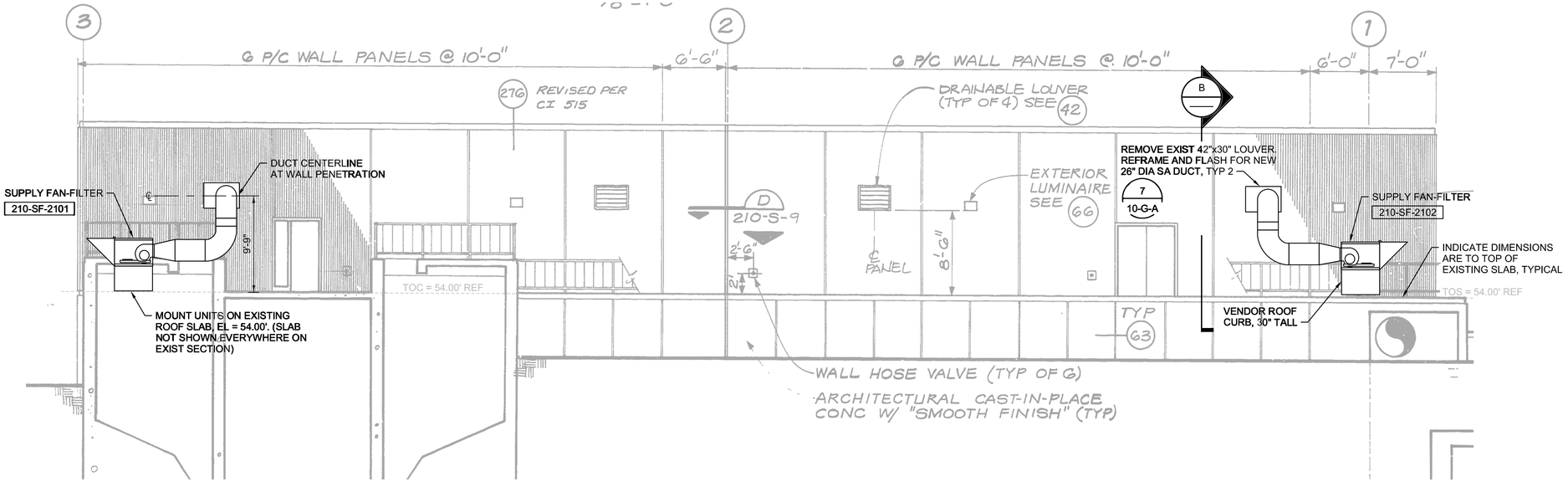
Jacobs

PRIMARY CLARIFIERS
HVAC PLAN

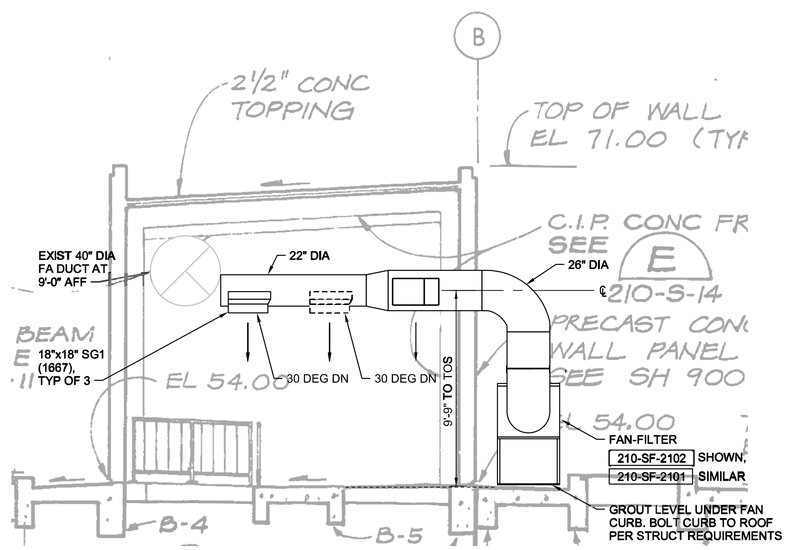
CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	210-H-2
SHEET	31 of 45



A SECTION
NTS
210-H-2



B SECTION
NTS
210-H-2

REGISTERED PROFESSIONAL ENGINEER 14586 Digital Signature OREGON JULY 26, 2022 JAMES H. SACKINGER
EXP. 06-30-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		S BAAR	R CARMONA	J SACKINGER	APVD	B FULLER	

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

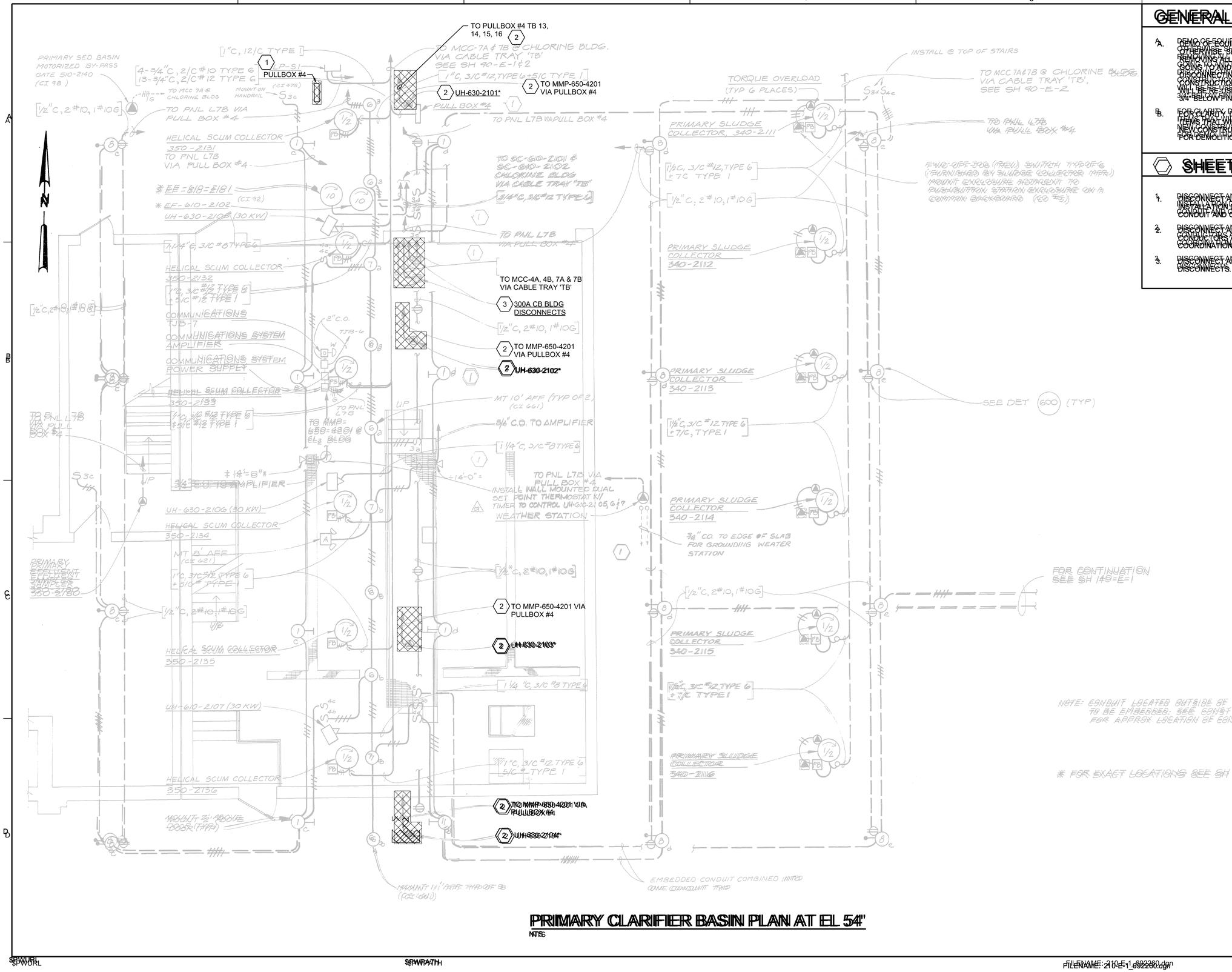
Jacobs

PRIMARY CLARIFIERS
HVAC
SECTIONS DETAILS

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	210-H-3
SHEET	32 of 45



PRIMARY CLARIFIER BASIN PLAN AT EL 54'

NTS

GENERAL NOTES

A. DEMO OF EQUIPMENT UNLESS NOTED OTHERWISE SHALL INCLUDE DISCONNECTING AND REMOVING ALL CONDUIT AND CONDUCTORS GOING TO AND FROM THE DEVICE PRIOR TO DISCONNECTING. COORDINATE WITH NEW CONSTRUCTION DESIGN FOR WHAT COMPONENTS WILL BE REUSED FOR EMBEDDED CONDUITS, CUT 3/4" BELOW FINISHED SURFACE AND CAP IN PLACE.

B. FOR CLARITY, DEMO SCOPE SHOWN IS ONLY FOR ITEMS THAT WILL NOT BE REPLACED AS PART OF NEW CONSTRUCTION. REFER TO SHEET 210-E-2 FOR DEMOLITION RELATED TO REPLACEMENTS.

SHEET KEYNOTES

1. DISCONNECT AND REMOVE PULL BOX #4. SEE NEW DISCONNECT AND REMOVE PULL BOX #4, SEE NEW INSTALLATION DWG 210-E-2, FOR EXTENDS OF CONDUIT AND CONDUCTORS TO REMAIN.
2. DISCONNECT AND REMOVE CONDUIT AND CONDUCTORS ASSOCIATED WITH UNIT HEATERS IN COORDINATION WITH HVAC DWG 210-H-1.
3. DISCONNECT AND REMOVE BUILDING DISCONNECTS.

REGISTERED PROFESSIONAL ENGINEER — OREGON — 63012PE — Digital Signature — MORGAN S. MOSTUE — EXP: 12-31-22

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NO.	DATE	DESIGN	DRAWN	CHK	APVD	BY	APVD
		J.HELEEN	DRR				B FULLER

REVISION

CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

PRIMARY CLARIFIERS
ELECTRICAL DEMOLITION PLAN

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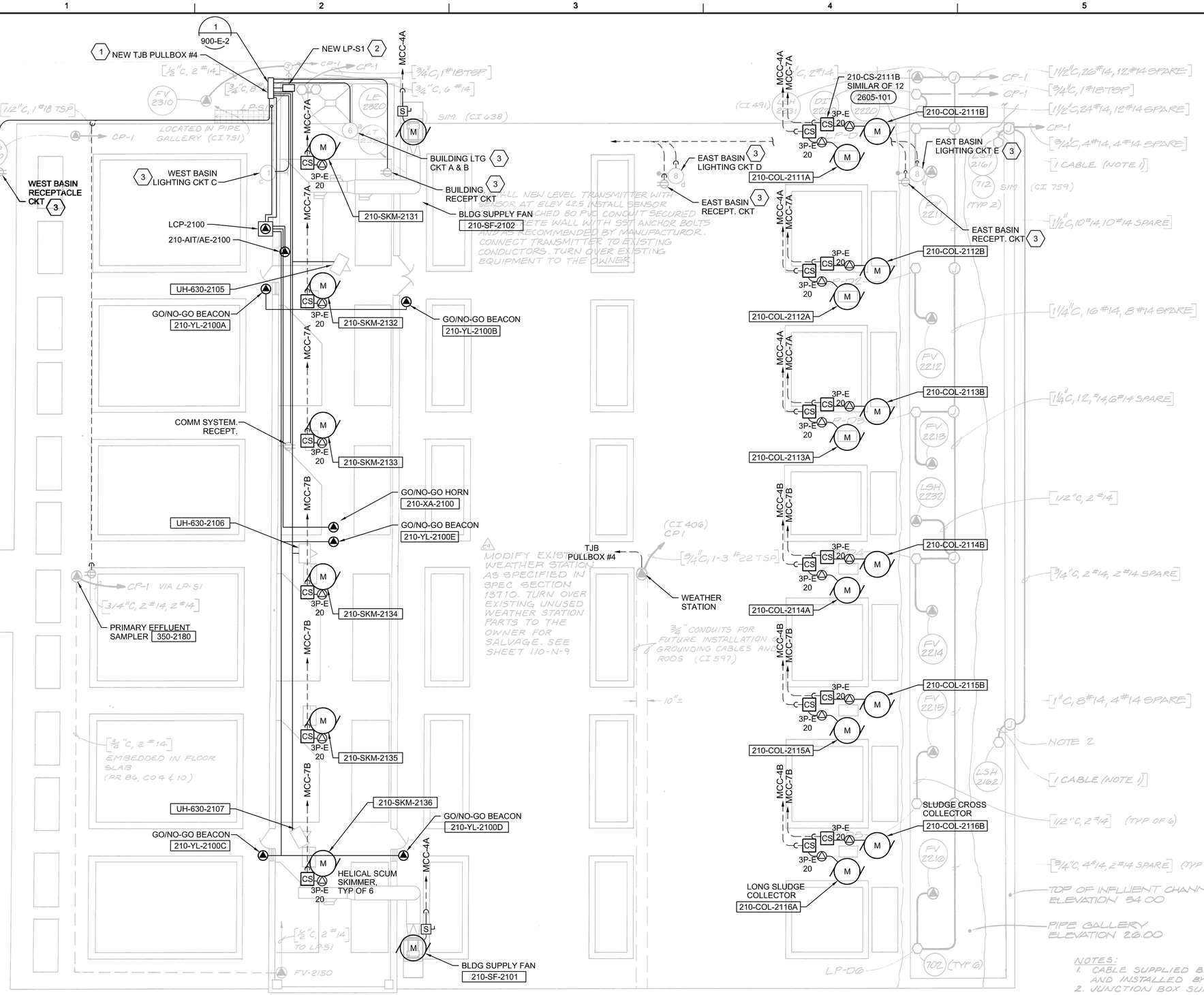
RELEASED FOR CONSTRUCTION DOCUMENTS

SCALE	AS SHOWN
SCALE	AS SHOWN
VERIFY SCALE	
IF BAR IS ONE INCH ON ORIGINAL DRAWING, ADJUST SCALE ACCORDINGLY	
DATE	JUNE 2022
DATE	JUNE 2022
PROJ	692260
PROJ	692260
DWG	210-E-1
DWG	210-E-1
SHEET	33 of 45
SHEET	33 of 45



PRIMARY CLARIFIER BASIN PLAN AT EL 54'

NTS

GENERAL NOTES

A. FOR WIRING REQUIREMENTS, SEE ONE-LINE DIAGRAMS ON DWG 420-E-2 & 420-E-3, MOTOR SCHEMATICS, ON DWG 900-E-1 AND RISER DIAGRAM ON DWG 900-E-2.

B. ROUTING SHOWN IS DIAGRAMMATIC ONLY, COORDINATE WITH OWNER FOR BEST ROUTING. IN GENERAL NEW INSTALLATIONS SHALL BE ALONG THE PERIMETERS OF BUILDINGS AND BASINS. WHERE THE LOAD IS NOT LOCATED ON THE PERIMETER, CORE DRILL AND ROUTE ON THE CEILING OF THE PRIMARY CLARIFIER TANK TO AVOID TRIP HAZARDS.

C. INSTALL SEAL-OFFS AS REQUIRED BY THE LATEST NEC AND IN ACCORDANCE WITH THE EC&MA TABLE ON DWG 900-E-4.

D. EXISTING CONDUIT DESIGNATED FOR RE-USE SHALL BE CONFIRMED BY CONTRACTOR TO BE IN SUITABLE CONDITION AND APPROVED BY OWNER. MANDREL AND CLEAN EXISTING CONDUIT BEFORE REUSE. PROVIDE AN ADDITIONAL WATER STOP AND CORROSION PROTECTION CURB PER DETAIL 2605-313 ON DRAWING 900-E-5 AT ALL EXPOSED PENETRATIONS.

E. EXISTING CABLE TRAY "TB" MAY BE UTILIZED FOR ROUTING WITHIN GALLERY, AFTER CONFIRMING/AS-BUILDING THE EXISTING CABLES TO PROVE CABLE TRAY FILL IS NOT EXCEEDED PER NEC REQUIREMENTS.

F. CONTINUATION TO BELOW GRADE GALLERY SHOWN ON DRAWING 210-E-4.

SHEET KEYNOTES

1. FURNISH AND INSTALL NEW TERMINAL JUNCTION BOX (TJB) "PULLBOX #4", ON EXTERIOR OF BUILDING, INTERCEPTING EXISTING CONDUIT AND CONDUCTORS COMING FROM THE GALLERY TO THE EXISTING PULLBOX #4. SEE DEMO DRAWING 210-E-1 FOR EXISTING LOCATION AND DWG 900-E-2 FOR RISER DIAGRAM.
2. FURNISH AND INSTALL NEW CONTROL PANEL, LP-S1, LOCATED IN THE SAME LOCATION AS EXISTING. SEE DWG 900-E-3 FOR FURTHER DETAILS.
3. DEVICE SHOWN IS DOCUMENTED AS THE FIRST DEVICE IN THE CIRCUIT, FIELD CONFIRM. IF DEVICE IS NOT THE FIRST, CONTRACTOR MAY REVISE PLAN TO ONLY RE-WIRE TO FIRST DEVICE FOUND. PROVIDE WRITTEN REQUEST TO OWNER BEFORE MAKING ANY CHANGES. AFTER COMPLETION OF WORK, TEST ALL FIXTURES WITHIN THE CIRCUIT ARE OPERATING CORRECTLY. SEE SHEET 210-E-1 FOR ORIGINAL DESIGN WITH ALL DEVICES CALLED OUT.

REGISTERED PROFESSIONAL ENGINEER — OREGON — 63012PE — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	APVD	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE		B FULLER		

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

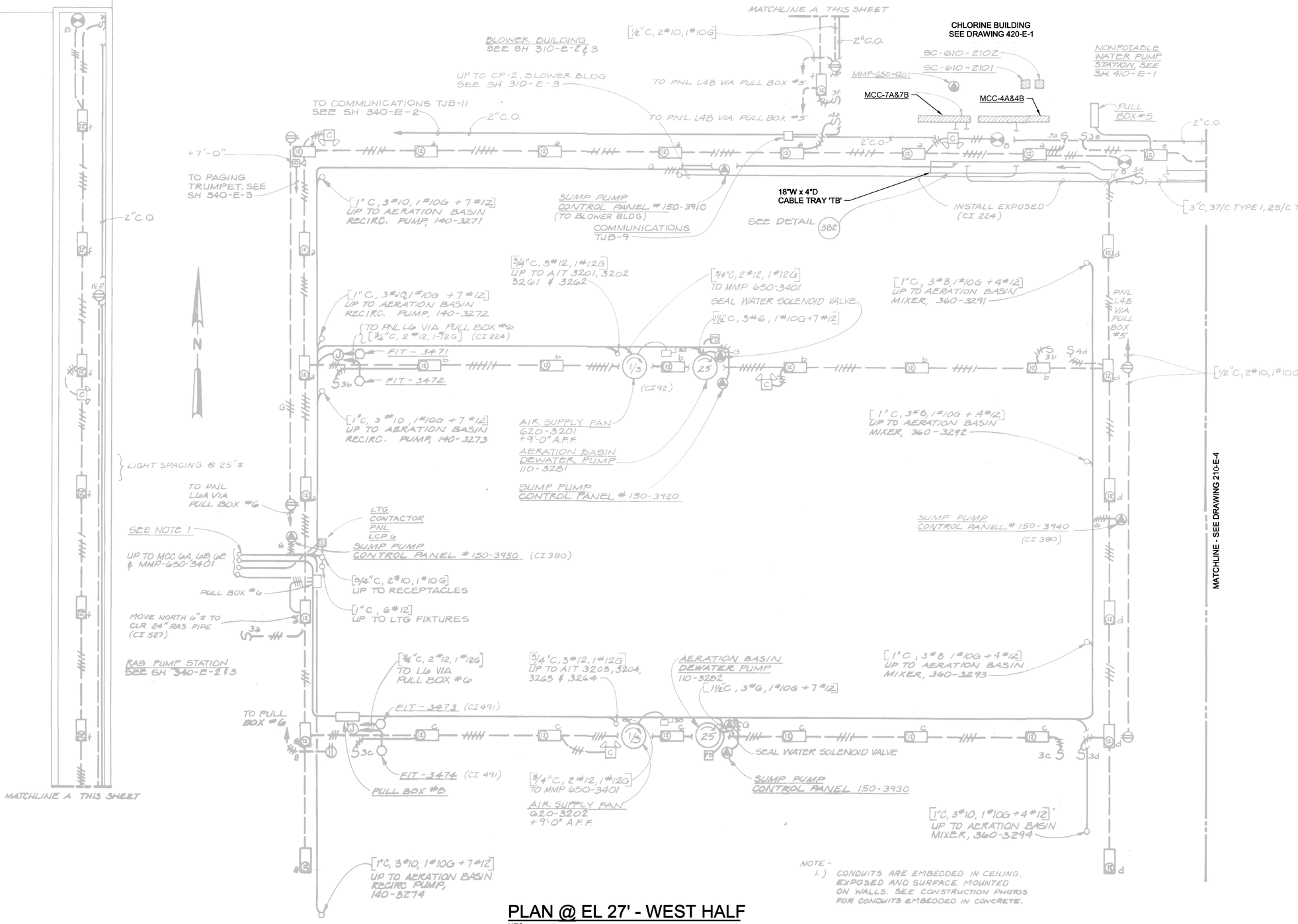
Jacobs

PRIMARY CLARIFIERS
ELECTRICAL PLAN

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	210-E-2
SHEET	34 of 45



PLAN @ EL 27' - WEST HALF

NTS

REGISTERED PROFESSIONAL ENGINEER — OREGON — 63012PE — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	REVISION	BY	APVD
DSGN	J HELLEN	DR S BRENNWALD	CHK M MACROSTIE	APVD B FULLER

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CLACKAMAS WATER ENVIRONMENT SERVICES

PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

PRIMARY CLARIFIERS
ELECTRICAL PLAN

CONTRACT DOCUMENTS

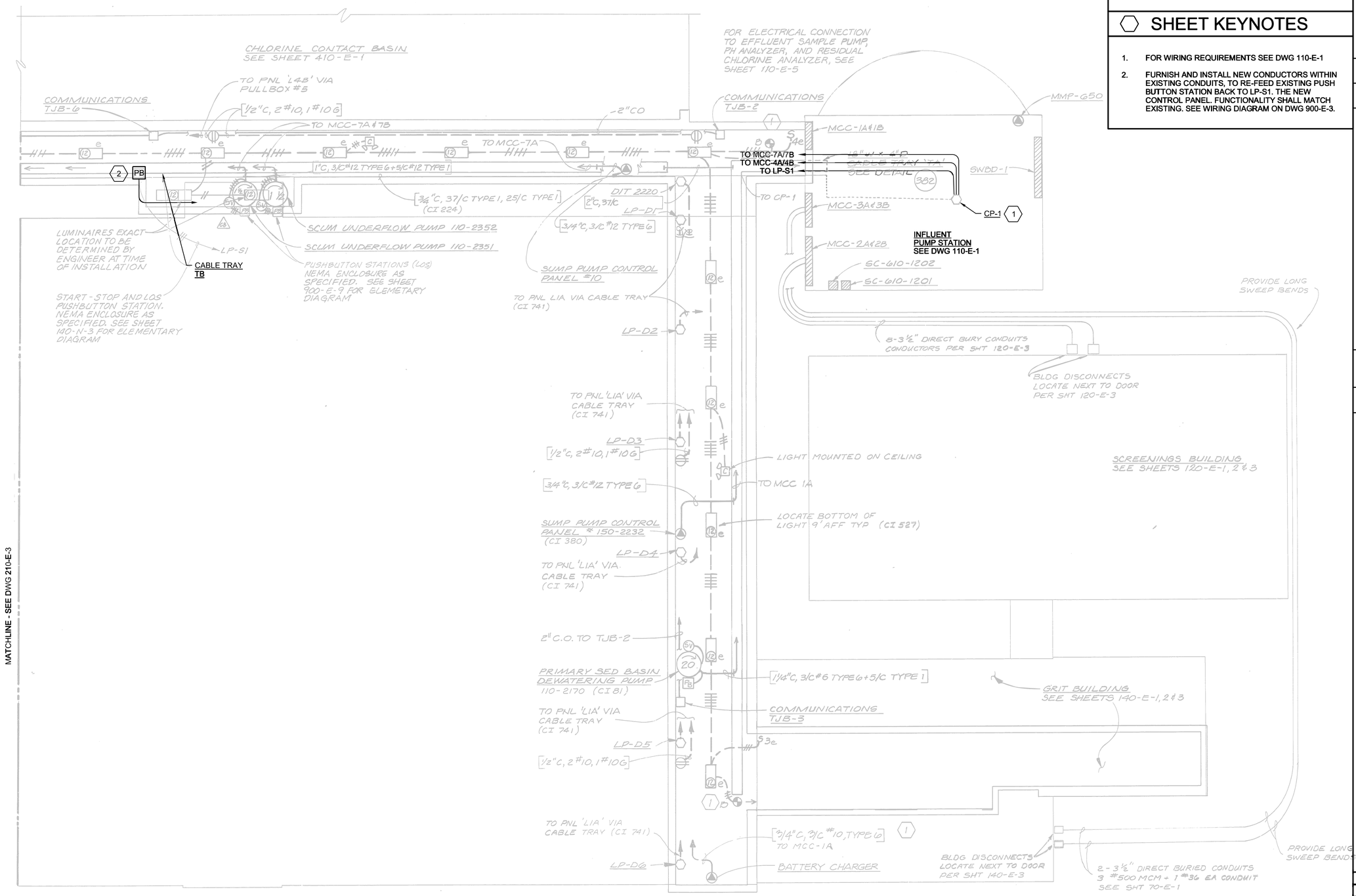
SCALE: AS SHOWN	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	JUNE 2022
PROJ	692260
DWG	210-E-3
SHEET	35 of 45

GENERAL NOTES

A. SEE SHEET 210-E-2 FOR WORK IN PRIMARY CLARIFIER BASIN AT EL 54'.

SHEET KEYNOTES

1. FOR WIRING REQUIREMENTS SEE DWG 110-E-1
2. FURNISH AND INSTALL NEW CONDUCTORS WITHIN EXISTING CONDUITS. TO RE-FEED EXISTING PUSH BUTTON STATION BACK TO LP-S1. THE NEW CONTROL PANEL. FUNCTIONALITY SHALL MATCH EXISTING. SEE WIRING DIAGRAM ON DWG 900-E-3.



PLAN @ EL 27' - EAST HALF

NTS

REGISTERED PROFESSIONAL ENGINEER — OREGON — 83072PE — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE		B FULLER	APVD

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CLACKAMAS WATER ENVIRONMENT SERVICES

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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

PRIMARY CLARIFIERS
ELECTRICAL PLAN

CONTRACT DOCUMENTS

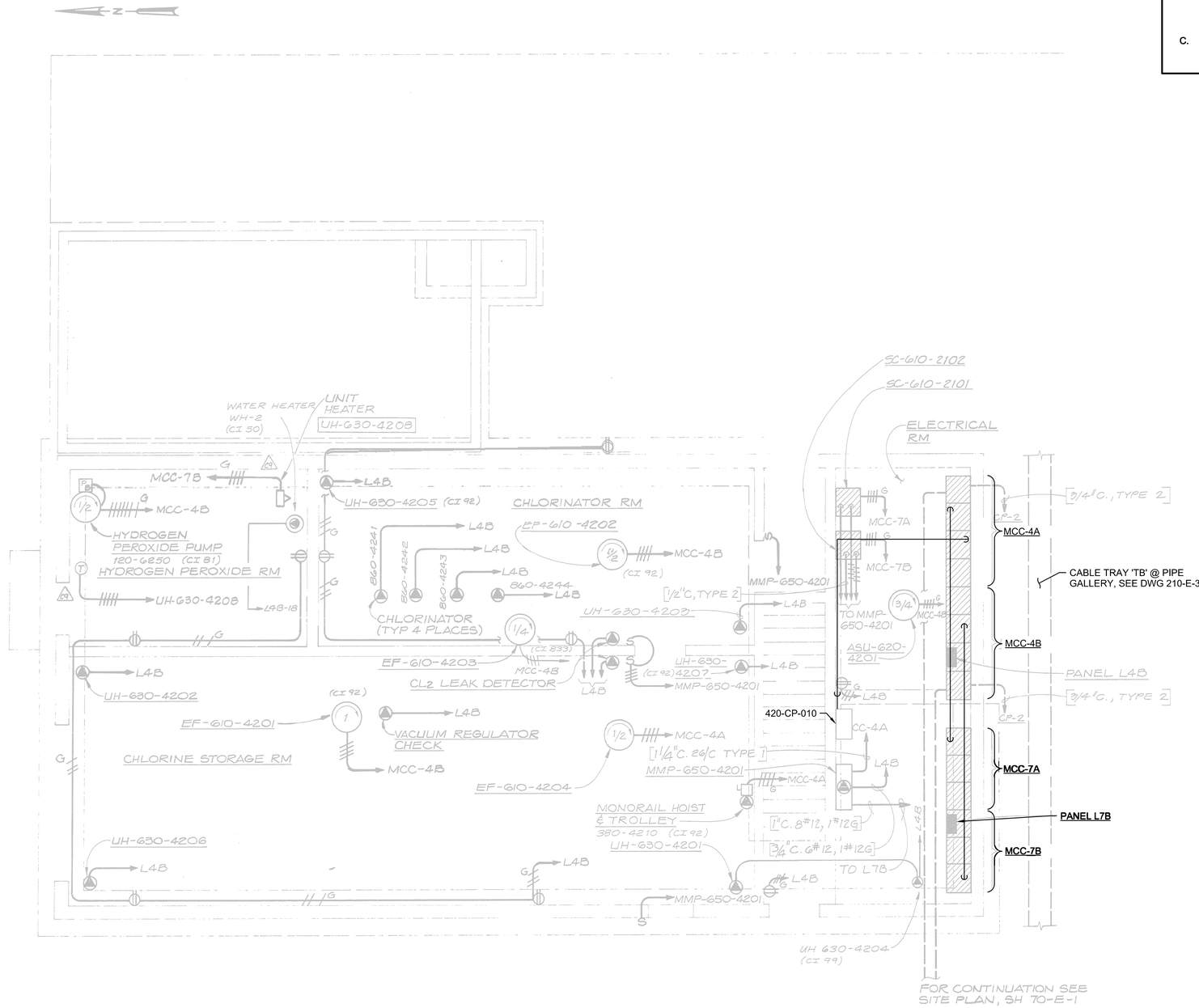
SCALE: AS SHOWN	
VERIFY SCALE	
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"	
DATE	JUNE 2022
PROJ	692260
DWG	210-E-4
SHEET	36 of 45

GENERAL NOTES

A. FURNISH AND INSTALL NEW MCC BUCKETS AS SHOWN ON ONE-LINE DIAGRAM 420-E-2 & 420-E-3.

B. FURNISH AND INSTALL NEW CONDUIT AND CONDUCTORS PER ONE LINE DIAGRAMS ON DWGS 420-E-2 & 420-E-3, MOTOR CONTROL DIAGRAMS ON DWG 900-E-1 AND RISER DIAGRAMS ON DWG 900-E-2.

C. REFERENCE PANEL SCHEDULE FOR PANEL L7B ON DWG 900-E-4.



POWER PLAN
NTS

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE	APVD	B FULLER	

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

CHLORINE BUILDING
ELECTRICAL PLAN

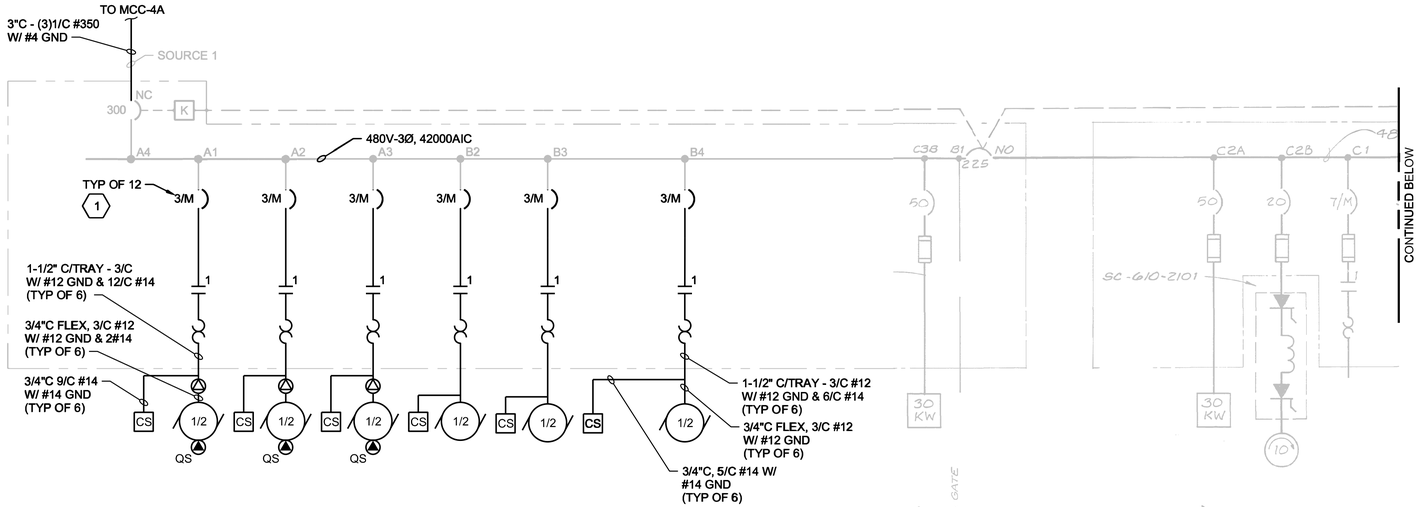
CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING, 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	420-E-1
SHEET	37 of 45

GENERAL NOTES

A. REMOVE EXISTING MCC BUCKET AND FURNISH AND INSTALL NEW MCC BUCKETS, COMPATIBLE WITH THE EXISTING MCC TYPE WESTINGHOUSE FIVE STAR. LABEL NEW BUCKETS WITH CORRESPONDING LABELS.

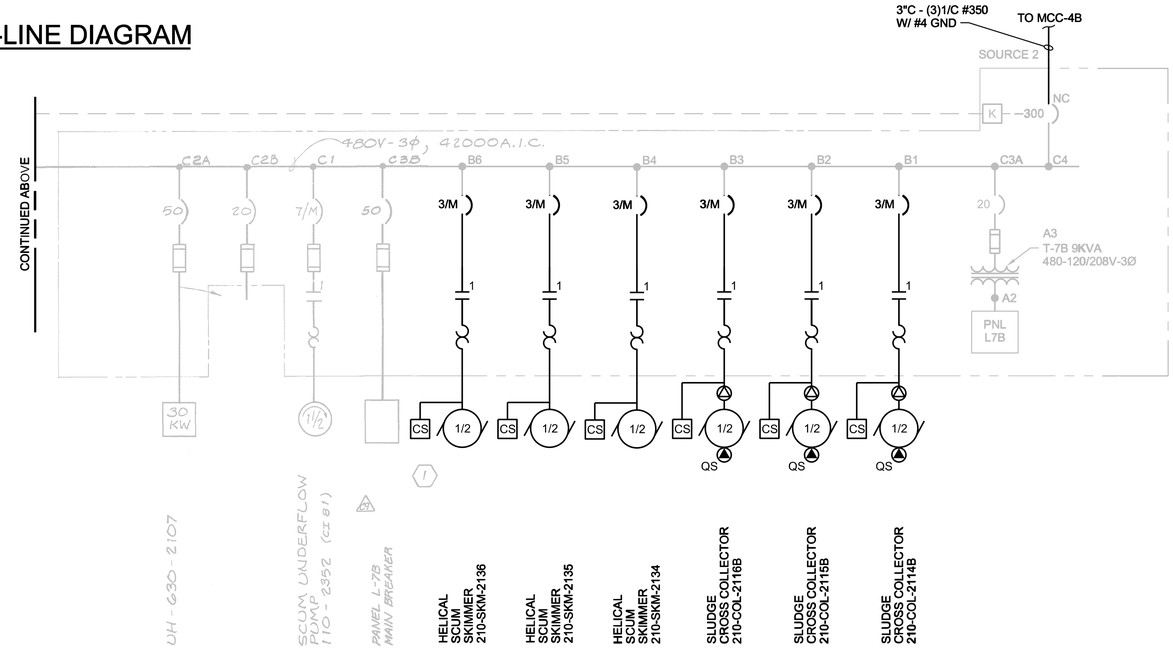


MCC 7A ONE-LINE DIAGRAM

NTS

A	B	C		A	B	C	
1 210-COL-2111B	1 510-2140			BUS TIE	1 210-COL-2114B	1 110-2152	
2 210-COL-2112B	2 210-SKM-2131	1 TIE BREAKER		1 PANEL L7B	2 210-COL-2115B	2A UH-630-2107	2B SPARE
3 210-COL-2113B	3 210-SKM-2132				3 210-COL-2116B	3A T-7B PRIMARY CB	3B L7B MAIN CB
4 SPACE	4 210-SKM-2133	2		2 SPACE	4 210-SKM-2134	4 INCOMING	
5 INCOMING	5 UH-630-4208	3A UH-630-2105	3B UH-630-2106	3 T-7B	5 210-SKM-2135		
	6 110-2151	4A SUMP PUMP CONTROL PANEL	4B SPARE		6 210-SKM-2136		

MCC-7A AND MCC-7B ELEVATION



MCC 7B ONE-LINE DIAGRAM

NTS

REGISTERED PROFESSIONAL ENGINEER — OREGON — MORGAN S. MACROSTIE — 63012PE — Digital Signature — EXP: 12-31-22

NO.	DATE	DSGN
		J HELLEN
		DR
	REVISION	S BRENNWALD
	CHK	M MACROSTIE
	APVD	
	BY	APVD
		B FULLER

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PRIMARY CLARIFIER REHABILITATION
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CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

CHLORINE BUILDING
ELECTRICAL
MCC 7A AND 7B
ONE-LINE DIAGRAM

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	JUNE 2022
PROJ	692260
DWG	420-E-2
SHEET	38 of 45

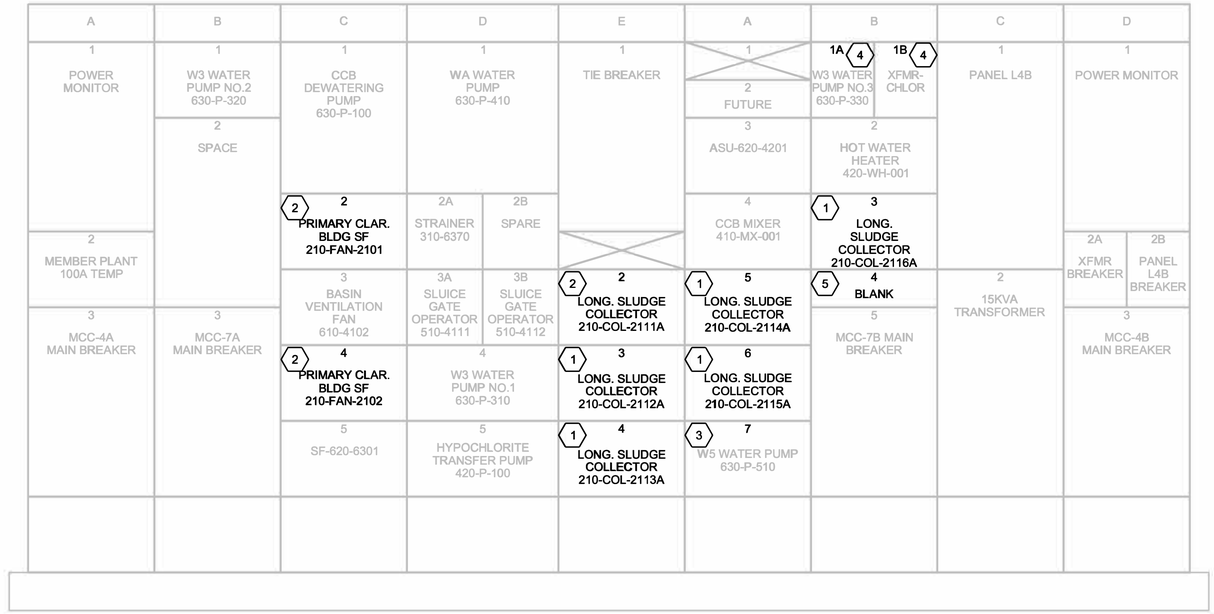
GENERAL NOTES

A. RELABEL ALL BUCKETS AFFECTED BY THE CHANGES MADE.

B. CONFIRM ALL NEW BUCKETS ARE COMPATIBLE WITH THE EXISTING MCC TYPE WESTINGHOUSE FIVE STAR.

⬡ SHEET KEYNOTES

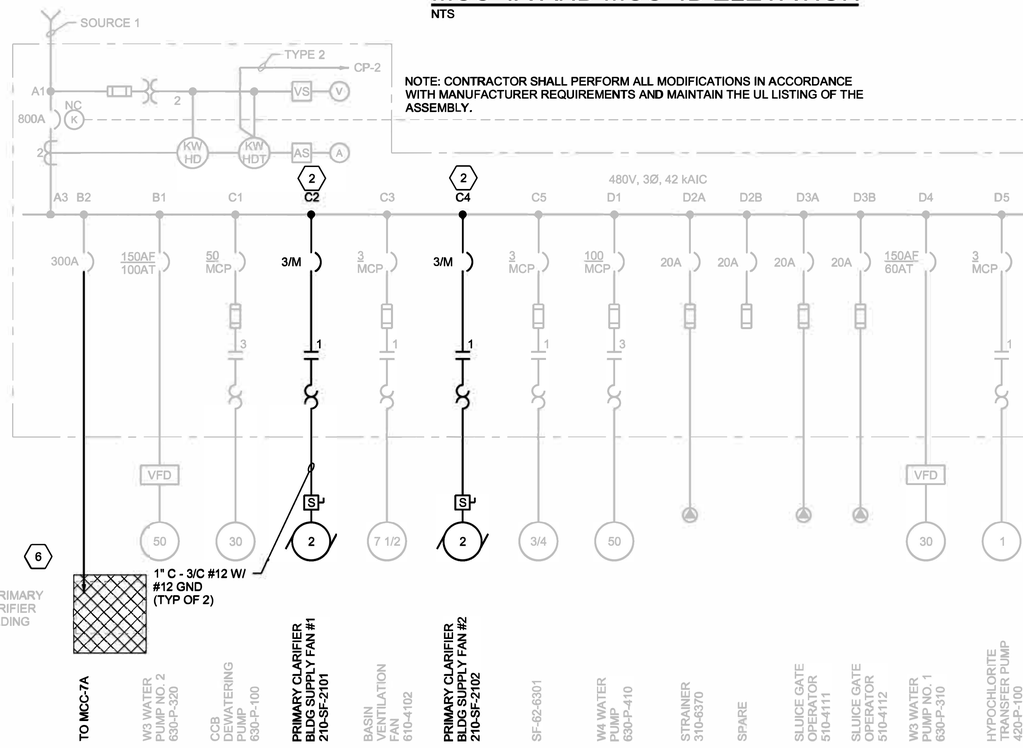
1. FURNISH AND INSTALL NEW MCC BUCKET.
2. REMOVE EXISTING MCC BUCKET AND FURNISH AND INSTALL A NEW MCC BUCKET COMPATIBLE WITH EXISTING LINEUP.
3. RELOCATE W5 WATER PUMP 630-P-510 MCC BUCKET DOWN 6" AND RELABEL AS A7.
4. CONVERT SINGLE BREAKER BUCKET TO A DUAL BREAKER BUCKET. OWNER WILL SUPPLY NEW DUAL BREAKER DIVIDER, CONTRACTOR SHALL PROVIDE NEW DOOR AND ALL OTHER HARDWARE REQUIRED FOR COMPLETED ASSEMBLY. RELOCATE XFMR-CHLOR BREAKER FROM A5 TO MCC BUCKET B1B.
5. FURNISH AND INSTALL A 6" COVER PLATE FOR THE BLANK SECTION.
6. DISCONNECT AND REMOVE PRIMARY DISCONNECTS FROM THE CLARIFIER BUILDING AND RE-FEED MCC-7A AND MCC-7B DIRECTLY FROM MCC-4A AND MCC-4B RESPECTIVELY.



MCC-4A AND MCC-4B ELEVATION

NTS

NOTE: CONTRACTOR SHALL PERFORM ALL MODIFICATIONS IN ACCORDANCE WITH MANUFACTURER REQUIREMENTS AND MAINTAIN THE UL LISTING OF THE ASSEMBLY.



(E) MCC-4A SINGLE LINE DIAGRAM - MODIFICATIONS

(E) MCC-4B SINGLE LINE DIAGRAM - MODIFICATIONS

REGISTERED PROFESSIONAL ENGINEER — 83972PE — Digital Signature — OREGON — 24-11, 2022 — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	C MCCOY	M MACROSTIE		B FULLER	

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CLACKAMAS WATER ENVIRONMENT SERVICES

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WATER RESOURCE RECOVERY FACILITY

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CHLORINE BUILDING
ELECTRICAL
MCC 4A AND 4B
ONE-LINE DIAGRAM

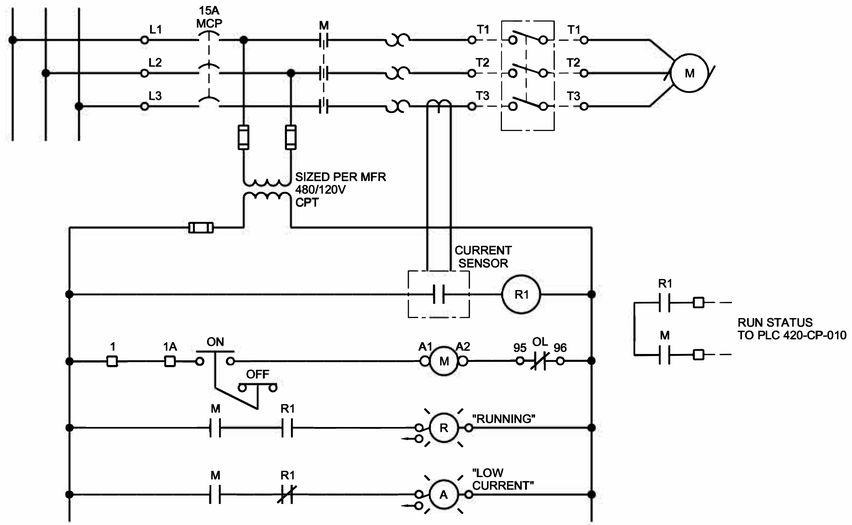
CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	420-E-3
SHEET	39 of 45

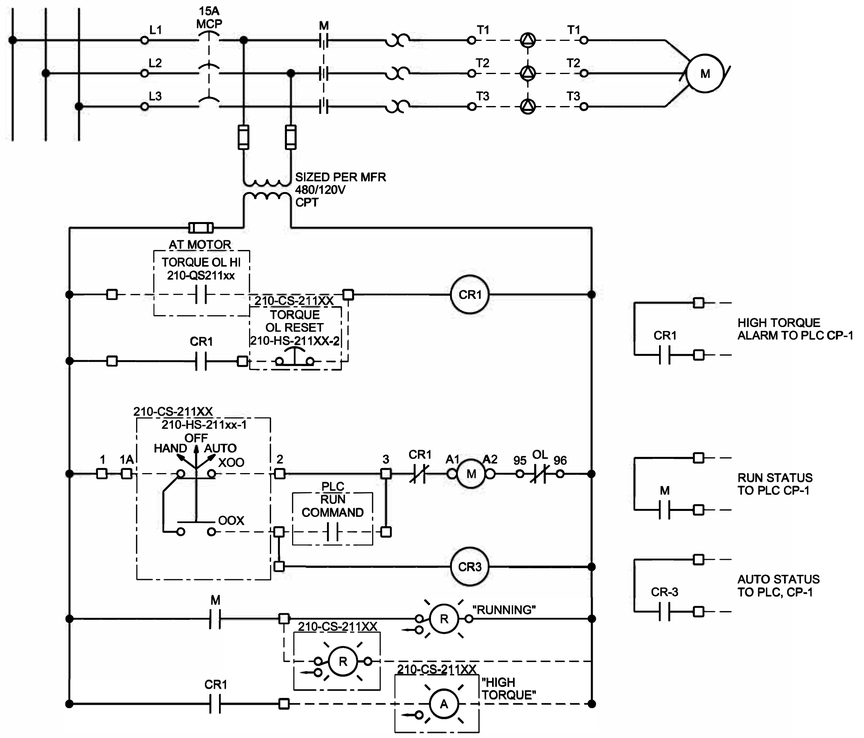
SHEET KEYNOTES

1. REPLACE THE MOTOR, FIELD DEVICES AND INTERCONNECT WIRING FOR THE (6) HELICAL SCUM SKIMMER, AS SHOWN. FUNCTIONALITY SHALL REMAIN THE SAME AS EXISTING.
2. CONFIRM PLC RUN COMMAND IS ROUTED THROUGH FIELD HOA SWITCH. IF ACTUAL ROUTING IS THROUGH THE MCC MOTOR STARTER INSTEAD OF HOW IT IS SHOWN THEN WIRING CAN BE LEFT AS IS.



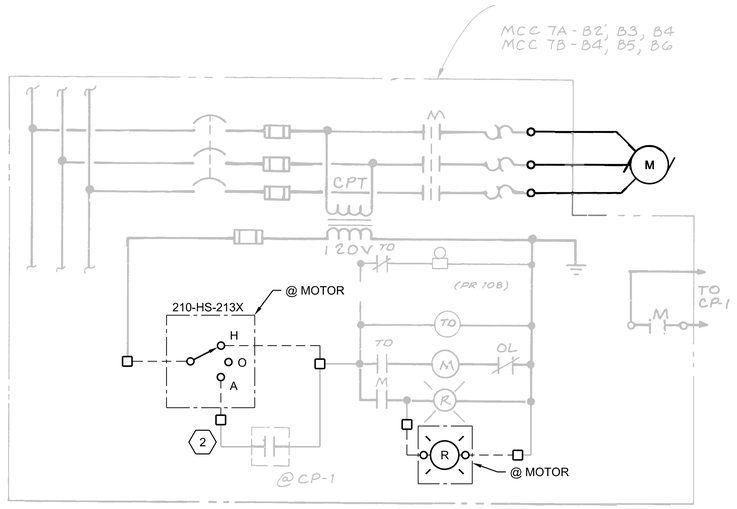
PRIMARY CLARIFIER BLDG SUPPLY FANS 210-SF-2101/2

NTS



LONG. & CROSS SLUDGE COLLECTOR (210-COL-2111A/B THRU 210-COL-2116A/B)

NTS



① HELICAL SCUM SKIMMER (210-SKM-2131 THRU 210-SKM-2136)

NTS

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NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE	APVD	B FULLER	

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CONTRACT DOCUMENTS

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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

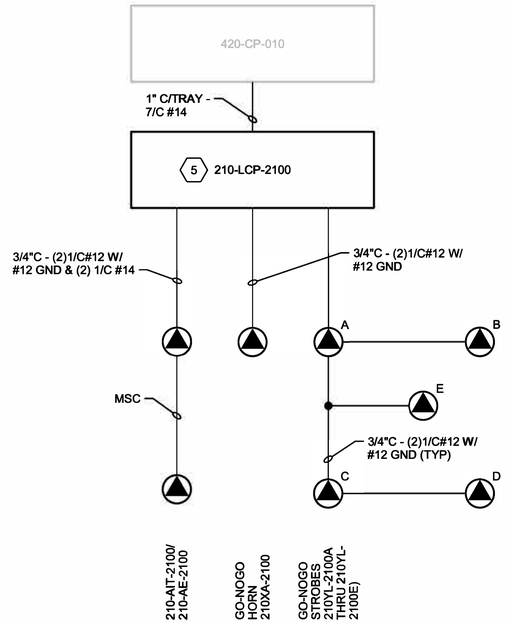
ELECTRICAL

MOTOR CONTROL DIAGRAMS

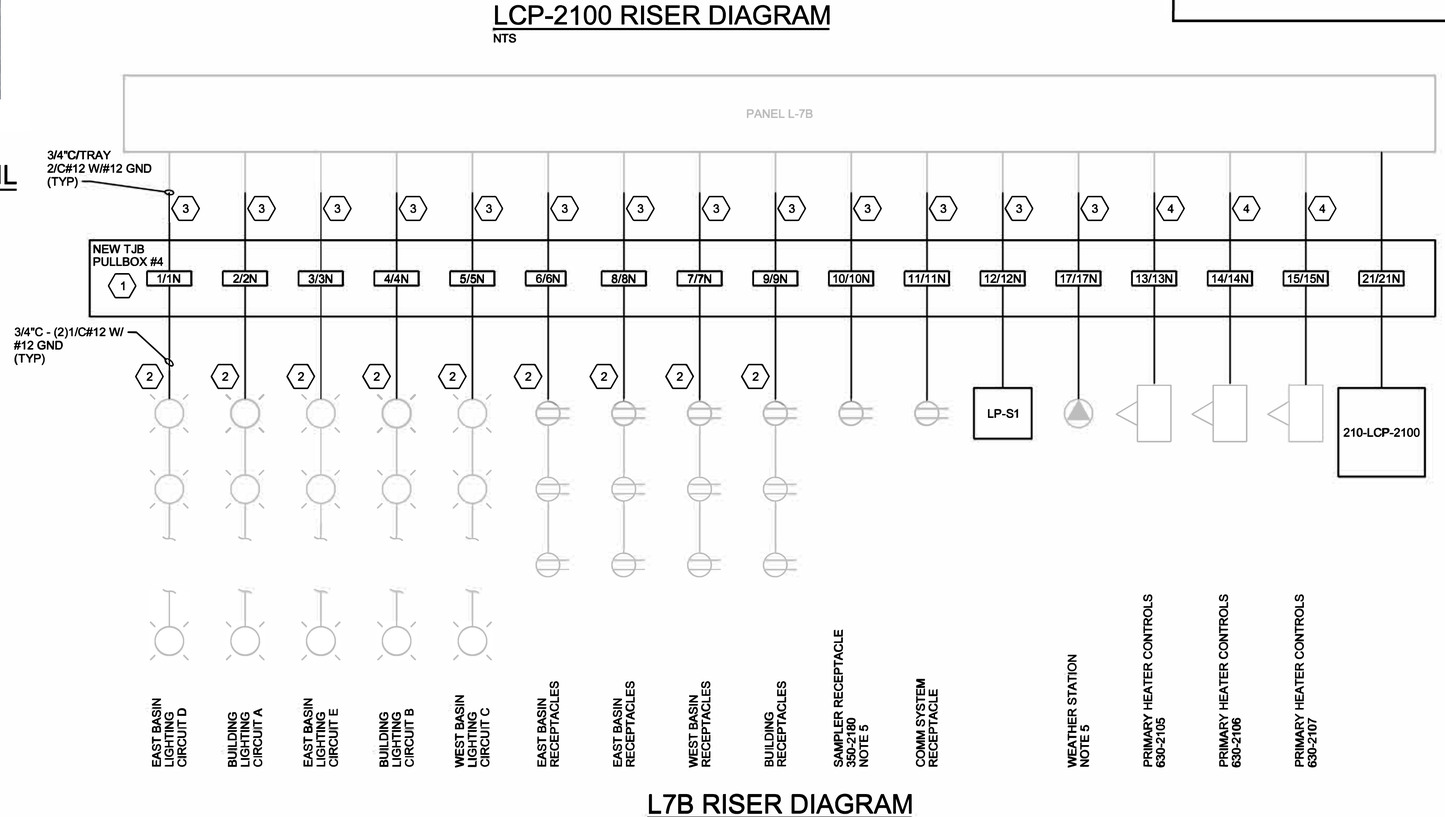
SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	900-E-1
SHEET	40 of 45

1 TJB PULLBOX #4 MOUNTING DETAIL
NTS
210-E-2



LCP-2100 RISER DIAGRAM
NTS



L7B RISER DIAGRAM
NTS

GENERAL NOTES

A. SEE ONE-LINE DIAGRAMS DWG 420-E-2 AND 420-E-3 FOR 480V WIRING REQUIREMENTS AND MOTOR SCHEMATIC, DWG 900-E-1 FOR ADDITIONAL CONTROL WIRING REQUIREMENTS.

B. EXISTING DEVICES MUST REMAIN IN SERVICE DURING CONSTRUCTION IN ACCORDANCE WITH SPECIFICATION 01 31 13, PROJECT COORDINATION.

C. FURNISH AND INSTALL NEW CONDUIT AND CONDUCTORS WHERE INDICATED BY DARKENED TEXT/LINEWORK.

D. CONDUIT AND CONDUCTOR SIZES SHOWN FOR EXISTING SYSTEMS ARE MINIMUM REQUIREMENTS ONLY, MATCH EXISTING SIZES.

SHEET KEYNOTES

1. FURNISH AND INSTALL NEW TERMINAL JUNCTION BOX (TJB) "PULLBOX #4", INTERCEPTING EXISTING CONDUIT AND CONDUCTORS COMING FROM THE GALLERY TO THE EXISTING PULLBOX #4. SEE DEMO DRAWING 210-E-1 FOR EXISTING LOCATION AND DWG 210-E-2 FOR NEW TERMINAL BOX LOCATION.
2. FIELD VERIFY FIRST DEVICE IN MULTI-DEVICE CIRCUITS AND RE-WIRE TO THE CLOSEST DEVICE.
3. DISCONNECT AND PULL THE EXISTING CONDUCTORS FROM THE CURRENT PULLBOX #4 BACK INTO THE GALLERY AND RE-TERMINATE AT THE NEW PULLBOX #4 THROUGH THE NEWLY ROUTED CONDUIT.
4. DISCONNECT AND PULL THE EXISTING CONDUCTORS FROM THE LOAD DEVICE BACK INTO THE GALLERY AND RE-TERMINATE AT THE NEW PULLBOX #4 THROUGH THE NEWLY ROUTED CONDUIT.
5. FURNISH AND INSTALL NEW LOCAL CONTROL PANEL FOR GO-NOGO SYSTEM. SEE I&C DRAWING 100-N-62 FOR FURTHER DETAIL.

REGISTERED PROFESSIONAL ENGINEER — OREGON — 83729PE — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY	REVISION
		J HELLEN	S BRENNWALD	M MACROSTIE	APVD	B FULLER	

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

Jacobs

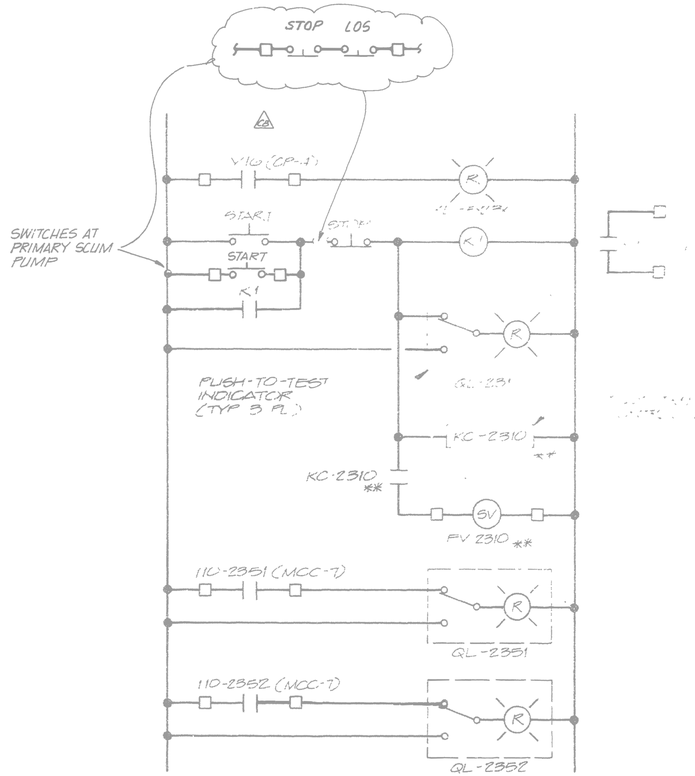
ELECTRICAL
PHOTO DETAIL AND RISER DIAGRAMS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	900-E-2
SHEET	41 of 45

LP-S1 PANEL EXTERIOR
NTS

LP-S1 PANEL INTERIOR
NTS



PANEL SCHEDULE		
ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION FIRST LINE / SECOND LINE
1	~~XL-5230(ON)~~	~~FLOAT THICKENER / STATUS~~
2	HS-2130(OFF)	SCUM COLLECTOR / OVERRIDE
3	QL-2310(ON) HS-2310(SS)	SCUM PUMP / 130-2310
4	QL-2351(ON) HS-2351(HOA)	SCUM UNDERFLOW / PUMP 110-2351
5	QL-2352(ON) HS-2352(HOA)	SCUM UNDERFLOW / PUMP 110-2352

NOT USED

LOCAL PANEL LP-S1
NTS

GENERAL NOTES

A. FIELD VERIFY THE EXISTING FUNCTIONALITY OF CONTROL PANEL LP-S1 IN PREPARATION OF REPLACEMENT. SCHEMATIC SHOWN IS OF THE ORIGINAL DESIGN BUT DOES NOT REFLECT MODIFICATIONS SINCE.

REGISTERED PROFESSIONAL ENGINEER — OREGON — 83072PE — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY
		J HELLEN	S BRENNWALD	M MACROSTIE	B FULLER	

REVISION

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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

ELECTRICAL

LP-S1 WIRING DIAGRAM

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	900-E-3
SHEET	42 of 45

GENERAL NOTES

A. SELECT ALL EQUIPMENT AND MATERIALS PER THE ENVIRONMENTAL CONDITIONS AND MATERIALS APPLICATION (EC&MA) TABLE.

SHEET KEYNOTES

1. FIELD VERIFY PRIMARY HEATER CIRCUIT AS IT IS INCORRECTLY LABELED IN THE FIELD. CIRCUITS SHOWN ARE THE ASSUMED LOCATION.

PANEL: L7B
VOLTAGE: 120/208
MOUNTING: MCC-7B
LOCATION: CL2 BLDG

PHASE 3PH
FEED:
MAIN: BRKR
SIZE: 50A

REV	DESCRIPTION	BREAKER POLE	BREAKER AMPS	CKT. NO.	CKT. NO.	BREAKER AMPS	BREAKER POLE	DESCRIPTION	REV
0	SED BASIN LTG	1	20	1	2	20	1	SED BLDG LTG	0
0	SED BASIN LTG	1	20	3	4	20	1	SED BLDG LTG	0
0	SED BASIN LTG	1	20	5	6	20	1	SED BASIN RECEPT	0
0	SED BASIN RECEPT	1	20	7	8	20	1	SED BASIN RECEPT	0
0	SED BASIN RECEPT	1	20	9	10	20	1	SAMPLER 350-2180	0
0	COMMUNICATION SYSTEM RECEPT	1	20	11	12	20	1	LP-S1	0
1 0	PRIMARY HEATER 630-2105	1	20	13	14	20	1	PRIMARY HEATER 630-2106 (1)	0
1 0	PRIMARY HEATER 630-2107	1	20	15	16	20	1	SPARE	0
0	WEATHER STATION	1	20	17	18	20	1	SPACE	0
0	SPACE	1	20	19	20	20	1	SPACE	0
0	**LCP-2100, GO-NOGO CONTROL PANEL**	**1**	**20**	**21**	22	20	1	SPACE	0
0	SPACE	1	20	23	24	20	1	SCRUBBER LIGHTS	0

L7B PANEL SCHEDULE
NTS

ENVIRONMENTAL CONDITIONS AND MATERIALS APPLICATION (EC&MA) TABLE

LOCATION (4)	CONDITION	RIGID RACEWAY (1)	FLEXIBLE RACEWAY	DEVICE BOX AND CONDUIT BODY (6)	JUNCTION BOXES, PULLBOXES, AND WIREWAYS	SAFETY SWITCHES, DISCONNECTS AND BREAKERS	PANELBOARDS AND POWER CONTROL EQUIPMENT	CONTROL AND TERMINATION ENCLOSURES	SUPPORT AND FRAMING CHANNEL (3)
GENERAL									
CONCEALED	DRY	EMT	FMC	SHST	NEMA 1	N/A	N/A	N/A	N/A
CONCEALED	DAMP	PVC40	LFNC	N-MET	N-MET	N/A	N/A	N/A	N/A
EXPOSED TO IMPACT	DRY / WET	RGS / PRGS	N/A	CAST / PCAST	CAST	N/A	N/A	N/A	HDG / SS
DIRECT BURIED	WET + COR	PRGS / PVC80	N/A	N/A	CAST / CONCRETE	N/A	N/A	N/A	N/A
UNDER SLAB	DAMP	PRGS / PVC80	N/A	N/A	N/A	N/A	N/A	N/A	N/A
EMBEDDED	WET + COR	PVC40	LFNC	PVC	NEMA 4 CAST	N/A	N/A	N/A	N/A
TRANSITION: BURIED OR EMBEDDED TO EXPOSED	COR	PRGS	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SPECIFIC AREA: EXPOSED									
CHLORINE BUILDING	DRY	RGS	LFMC	CAST	NEMA 1	NEMA 1	NEMA 12	NEMA 12	HDG / SS
GALLERY	DAMP	RGS	LFMC	CAST	NEMA 12	NEMA 12	NEMA 12	NEMA 12	HDG / SS
SEDIMENTATION BASIN INTERIOR	HAZ1-1 + COR	PRGS	LFMC	PCAST	NEMA 7	N/A	N/A	N/A	SS / N-MET
SEDIMENTATION BASIN EXTERIOR	HAZ1-2 (7) + COR	PRGS	LFMC	PCAST	NEMA 4X	N/A	N/A	N/A	SS / N-MET
SEDIMENTATION BASIN EXTERIOR	WET + COR	PRGS	LFMC	PCAST	NEMA 4X	NEMA 4X	NEMA 4X	NEMA 4X	HDG / SS
SEDIMENTATION BASIN BUILDING	HAZ1-2 (8) + COR	PRGS	LFMC	PCAST	NEMA 4X	N/A	N/A	N/A	SS / N-MET

DEFINITIONS:
DRY = conditioned space, no condensation or other sources of moisture
DAMP = semi-conditioned space or protected space, moisture due to condensation or occasional splashing
WET = subject to direct water contact
CORROSIVE = exposure to uncommon chemical action such as salt air, hydrogen sulfide or hypochlorite
CONCEALED DRY = in drywall cavity
CONCEALED WET = in a block or masonry wall cavity
EMBEDDED = inside concrete wall, floor or slab
CAST = malleable iron with protective coating such as HDG

NOTES: (#)
1. Except when embedded, make transitions from one type of conduit to another only at pull points or accessible fittings.
2. Conductors in buried conduits shall have type XHHW-2 insulation.
3. HARDWARE: 316 SS for SS and FRP Chanel and/or HDG for HDG and EP Channel.
4. Installation must meet both GENERAL and SPECIFIC requirements.
5. By vehicle or other active equipment.
6. Device boxes and conduit bodies shall match conduit material unless noted otherwise.
7. HAZ1-2, classification includes a 3 foot horizontal and 1.5 foot vertical from all hatches and openings.
8. HAZ1-2, Declassified by ventilation.

SYMBOLS:
"/" = OR, "+" = AND

ABBREVIATIONS:
AL = Aluminum
COR = Corrosive
EP = Epoxy paint
FMC = Flexible metal conduit
FRP = Fiberglass reinforced plastic
HAZ = Hazardous #(class)=#(division)
HDG = Hot dipped galvanized
HDPE(##) = High density polyethylene (40/80)
LFMC = Liquidtight flexible metal conduit
LFNC = Liquidtight flexible non-metallic conduit
NEMA (#) = National Electrical Manufactures Association standard 250 (enclosure rating)
N-MET = Non-metallic
PCAST = PVC coated CAST
PRGS = PVC coated RGS
PVC(##) = Polyvinyl chloride (Schedule 40/80)
RGS = Rigid galvanized steel
SHST = Sheet steel
SS = Stainless steel

EC&MA TABLE
NTS

REGISTERED PROFESSIONAL ENGINEER — OREGON — 83072S — Digital Signature — MORGAN S. MACROSTIE — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	REVISION	BY	APVD
		J HELLEN	S BRENNWALD	M MACROSTIE			B FULLER	

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PRIMARY CLARIFIER REHABILITATION
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

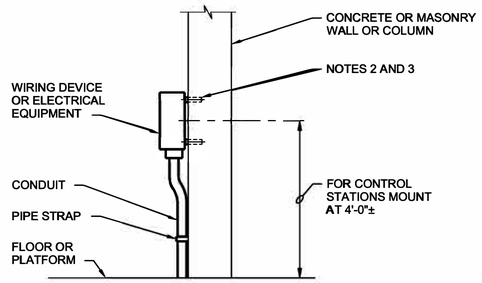
Jacobs

ELECTRICAL
SCHEDULES

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	900-E-4
SHEET	43 of 45

CONTRACT DOCUMENTS



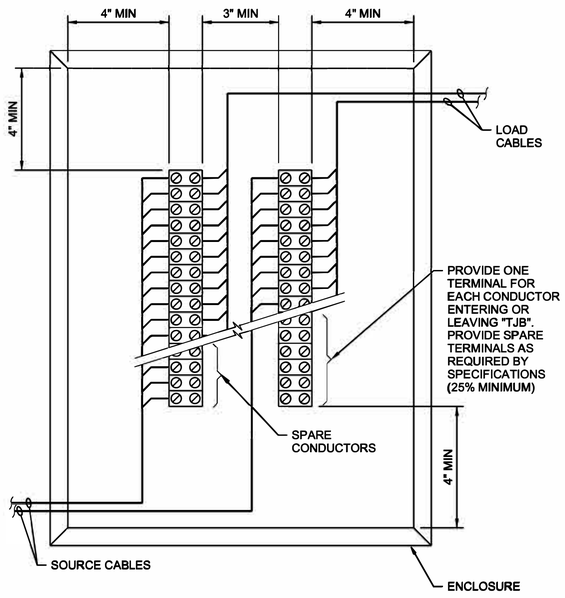
NOTES:

1. ALL MOUNTING HARDWARE SHALL BE STAINLESS STEEL. USE BOTH WASHER AND LOCK WASHERS UNDER ALL NUTS.
2. ON CONCRETE WALLS USE STAINLESS STEEL CONCRETE ANCHORS. MOUNT ENCLOSURE ON SPACERS OF MIN 1/2" SCHEDULE 80 PVC CONDUIT.
3. BOXES 6 INCHES SQUARE AND SMALLER SHALL BE SUPPORTED BY TWO ANCHORS, MIN. LARGER BOXES SHALL BE SUPPORTED AS REQUIRED BY CALCULATION; FOUR ANCHORS MIN.
4. SUBMIT FINAL DESIGN AND CALCULATIONS FOR SUPPORT AND ANCHORAGE AS SPECIFIED.

JB MOUNTING, WALL OR COLUMN

2605-002

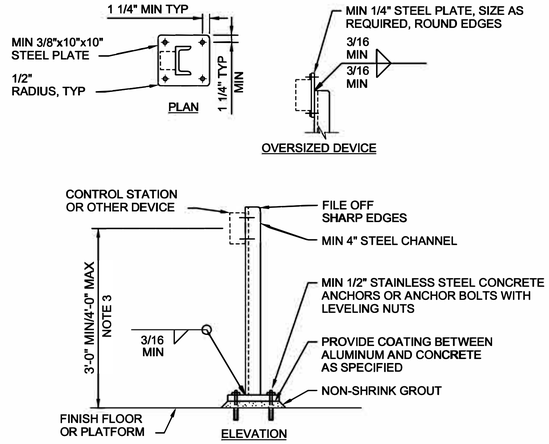
NTS



TERMINAL JUNCTION BOX

2605-102

NTS



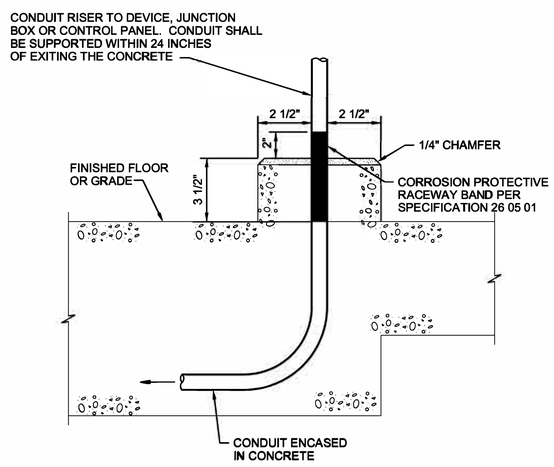
NOTES:

1. ALL MOUNTING HARDWARE SHALL BE STAINLESS STEEL. USE WASHERS AND LOCK WASHERS UNDER ALL NUTS AND BOLTS.
2. EXTEND POSTS TO STRUCTURE ABOVE WHERE REQUIRED BY CALCULATION. EXTENSION SHALL ACCOMODATE DEFLECTION OF THE SUPPORTING STRUCTURE
3. SUBMIT FINAL DESIGN AND CALCULATIONS FOR SUPPORT AND ANCHORAGE AS SPECIFIED.
4. MINIMUM COMPONENT AND CONNECTION SIZES SHOWN. FURNISH LARGER SIZES AS REQUIRED BY CALCULATIONS.
5. HOT-DIP GALVANIZE ASSEMBLY AFTER FABRICATION.

MOTOR CONTROL STATION MOUNTING

2605-011a

NTS



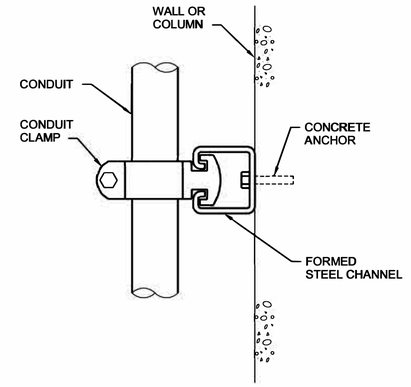
NOTES:

1. EXISTING CONDUITS SHOWING SIGNS OF CORROSION SHALL BE INSTALLED WITH THE ADDED PROTECTION IN ACCORDANCE WITH THIS DETAIL. ALL NEW CONDUIT MATERIAL SHALL BE SELECTED PER EC&MA TABLE AND DO NOT NEED THE ADDED PROTECTION.

EXISTING CONDUIT PROTECTIVE CURB

2605-313

NTS



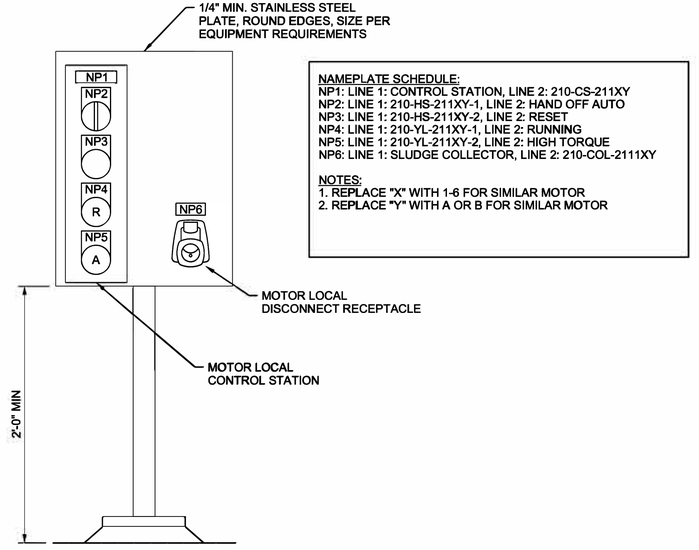
NOTES:

1. SUPPORT ALL EXPOSED CONDUITS ON FORMED STEEL CHANNELS.
2. SUBMIT FINAL DESIGN AND CALCULATIONS FOR SUPPORT AND ANCHORAGE AS SPECIFIED.

UNISTRUT MOUNTING

2605-017

NTS



NAMEPLATE SCHEDULE:
NP1: LINE 1: CONTROL STATION, LINE 2: 210-CS-211XY
NP2: LINE 1: 210-HS-211XY-1, LINE 2: HAND OFF AUTO
NP3: LINE 1: 210-HS-211XY-2, LINE 2: RESET
NP4: LINE 1: 210-YL-211XY-1, LINE 2: RUNNING
NP5: LINE 1: 210-YL-211XY-2, LINE 2: HIGH TORQUE
NP6: LINE 1: SLUDGE COLLECTOR, LINE 2: 210-COL-2111XY

NOTES:
1. REPLACE "X" WITH 1-6 FOR SIMILAR MOTOR
2. REPLACE "Y" WITH A OR B FOR SIMILAR MOTOR

NOTES:

1. INSTALL CONTROL STATION PER MOUNTING DETAIL 2605-011A. MOUNTING HEIGHTS SHOULD CONFORM TO BOTH THIS DETAIL AND THE CENTER HEIGHT OF 2605-011A.
2. INSTALL SEAL-OFF ON ALL CONDUITS PASSING THROUGH THE HAZARDOUS LOCATION PER NEC REQUIREMENTS. SEE DRAWING 900-E-4 FOR HAZARDOUS LOCATION BOUNDARIES.
3. INSTALL NAMEPLATES PER SPECIFICATIONS 26 05 01 REQUIREMENTS.

SLUDGE COLLECTOR CONTROL STATION

2605-101

NTS

REGISTERED PROFESSIONAL ENGINEER — OREGON — MORGAN S. MACROSTIE — Digital Signature — EXP. 12-31-22

NO.	DATE	DSGN	DR	CHK	APVD	BY
REVISION		J HELLEN	S BRENNWALD	M MACROSTIE	APVD	B FULLER

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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

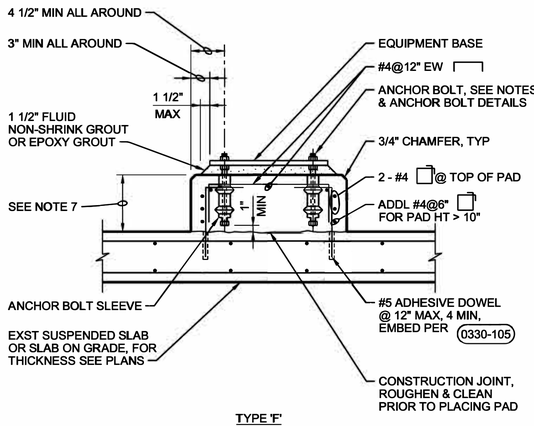
Jacobs

ELECTRICAL
DETAILS

CONTRACT DOCUMENTS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	900-E-5
SHEET	44 of 45

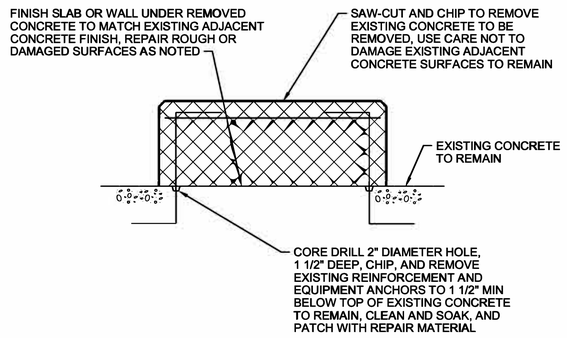


TYPE 'F'

GENERAL NOTE:
FOR GENERAL NOTES SEE DETAIL X OF X.

CONCRETE EQUIPMENT PAD - TYPE 'F'
NTS

0330-056



NOTES:

1. REMOVE CONCRETE OUT TO SOUND CONCRETE.
2. IF CHIPPING INTO THE SURFACE OF THE EXISTING SLAB OR WALL TO REMAIN IS REQUIRED, MAKE EDGES PERPENDICULAR TO THE SURFACE. DO NOT FEATHER EDGES.
3. FILL DEFECTIVE AREA WITH AN APPROVED PREPACKAGED REPAIR MATERIAL TO MATCH APPEARANCE OF ADJACENT CONCRETE SURFACES.
4. USE APPROVED BONDING AGENT ON SURFACES TO BE PATCHED PRIOR TO PLACING REPAIR MATERIAL.
5. DEMONSTRATE METHODS FOR REPAIR USING ACTUAL MATERIALS, METHODS, AND CURING PROCEDURES REQUIRED BY MATERIAL MANUFACTURERS. CONSULT WITH BONDING AGENT MANUFACTURER AND REPAIR MATERIAL MANUFACTURER ON TECHNIQUES.

CONCRETE DEMOLITION
NTS

0330-143

REGISTERED PROFESSIONAL ENGINEER — OREGON — JULY 21, 1982 — ALEX L. FIRTH — Digital Signature
EXP 12-31-23

NO.	DSGN	DATE	DR	CHK	BY	APVD
				REVISION		
		A FIRTH	H QUINNETT	L KING	B FULLER	

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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
WATER RESOURCE RECOVERY FACILITY

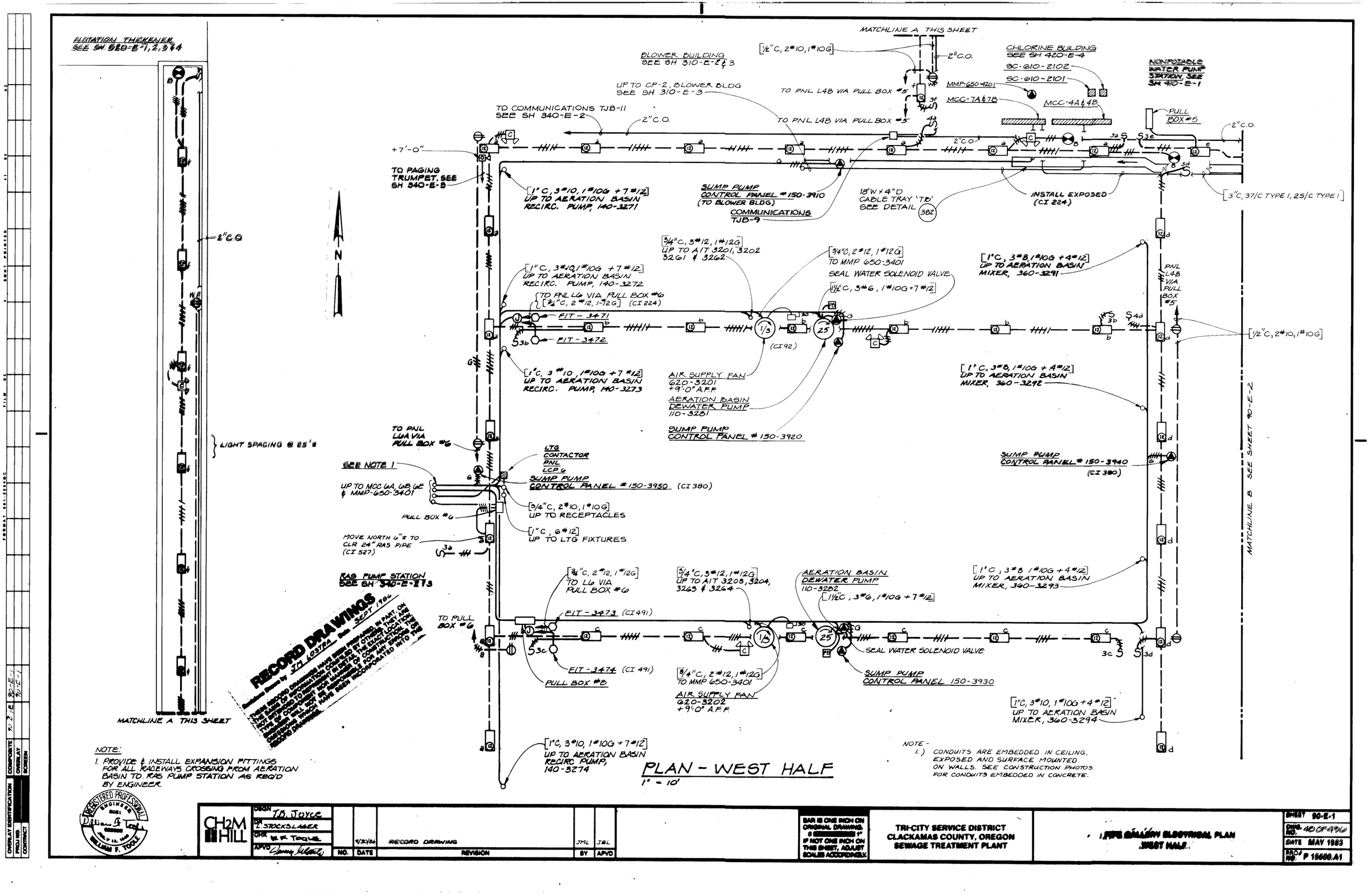
Jacobs

STRUCTURAL
STANDARD DETAILS

SCALE: AS SHOWN
VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"

DATE	JUNE 2022
PROJ	692260
DWG	999-S-1
SHEET	45 of 45

FERENCE DRAWI



RECORD DRAWINGS
Redlines Drawn by JCL KOSTKA Date SEPT 1986
THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION CONTAINED IN CONTRACTOR SUBMITTED DRAWINGS. THEY ARE NOT INTENDED TO REPRESENT EXACTLY THE EXTENT, LOCATION, TYPE OR COMPONENT PARTS OF ALL CONSTRUCTION. THE CONSTRUCTION MANAGER OR ENGINEER OF RECORD WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

NOTE:
1. PROVIDE & INSTALL EXPANSION FITTINGS FOR ALL RACEWAYS CROSSING FROM AERATION BASIN TO RAS PUMP STATION AS REQ'D BY ENGINEER.

NOTE -
1.) CONDUITS ARE EMBEDDED IN CEILING, EXPOSED AND SURFACE MOUNTED ON WALLS. SEE CONSTRUCTION PHOTOS FOR CONDUITS EMBEDDED IN CONCRETE.

PLAN - WEST HALF
1" = 10'

REGISTERED PROFESSIONAL ENGINEER OREGON JULY 12, 1985 WILLIAM F. TOOLE

CH2M HILL

DESIGN	T.D. JOYCE
DR	L. STROCKSLAGER
CHK	W. F. TOOLE
APVD	

NO.	DATE	REVISION	BY	APVD
	9/30/86	RECORD DRAWING	JML	JBL

BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

SITE GALLERY ELECTRICAL PLAN WEST HALF

SHEET 90-E-1
DWG. NO. 46 OF 4956
DATE MAY 1983
PROJ. NO. P 15668.A1

OVERLAY IDENTIFICATION: COMPOSITE 90-E-1; OVERLAY 90-E-1; SCREEN
PROJ NO
CONTRACT

CHLORINE CONTACT BASIN
SEE SHEET 410-E-1

TO PNL '148' VIA PULLBOX #5

COMMUNICATIONS TJB-6

1/2"C, 2#10, 1#10G

TO MCC-7A & 7B

TO MCC-7A

2"CO

1"C, 5/C #12 TYPE G + 5/C #12 TYPE I

3/4"C, 3/C #12 TYPE G

2"C, 3/C

LP-D1

DIT 2220

SCUM UNDERFLOW PUMP 110-2352

SCUM UNDERFLOW PUMP 110-2351

LUMINAIRES EXACT LOCATION TO BE DETERMINED BY ENGINEER AT TIME OF INSTALLATION

LP-B1

CABLE TRAY TB

PUSHBUTTON STATIONS (LOS) NEMA ENCLOSURE AS SPECIFIED. SEE SHEET 900-E-9 FOR ELEMETARY DIAGRAM

START-STOP AND LOS PUSHBUTTON STATION: NEMA ENCLOSURE AS SPECIFIED. SEE SHEET 180-N-3 FOR ELEMENTARY DIAGRAM

SUMP PUMP CONTROL PANEL #10

TO PNL L1A VIA CABLE TRAY (CI 741)

LP-D2

TO PNL 'L1A' VIA CABLE TRAY (CI 741)

LP-D3

1/2"C, 2#10, 1#10G

3/4"C, 3/C #12 TYPE G

SUMP PUMP CONTROL PANEL #150-2232 (CI 380)

LP-D4

TO PNL 'L1A' VIA CABLE TRAY (CI 741)

2" C.O. TO TJB-2

PRIMARY SED BASIN DEWATERING PUMP 110-2170 (CI 81)

TO PNL 'L1A' VIA CABLE TRAY (CI 741)

LP-D5

1/2"C, 2#10, 1#10G

TO PNL 'L1A' VIA CABLE TRAY (CI 741)

LP-D6

BATTERY CHARGER

3/4"C, 3/C #10, TYPE G TO MCC-1A

1/4"C, 3/C #6 TYPE G + 5/C TYPE I

COMMUNICATIONS TJB-3

LIGHT MOUNTED ON CEILING

TO MCC 1A

LOCATE BOTTOM OF LIGHT 9' AFF TYP (CI 527)

FOR ELECTRICAL CONNECTION TO EFFLUENT SAMPLE PUMP, PH ANALYZER, AND RESIDUAL CHLORINE ANALYZER, SEE SHEET 110-E-3

COMMUNICATIONS TJB-2

MMP-GB10-1101

MCC-1A & 1B

18" W x 4" D CABLE TRAY 'TA' SEE DETAIL 382

SWBD-1

TO CP-1

CP-1

MCC-3A & 3B

MCC-2A & 2B

INFLUENT PUMP STATION SEE SHEET 110-E-4 & 5

SC-610-1202

SC-610-1201

PROVIDE LONG SWEEP BENDS

8-3 1/2" DIRECT BURY CONDUITS CONDUCTORS PER SHT 120-E-3

BLDG DISCONNECTS LOCATE NEXT TO DOOR PER SHT 120-E-3

SCREENINGS BUILDING SEE SHEETS 120-E-1, 2 & 3

GRIT BUILDING SEE SHEETS 140-E-1, 2 & 3

BLDG DISCONNECTS LOCATE NEXT TO DOOR PER SHT 140-E-3

2-3 1/2" DIRECT BURIED CONDUITS 3 #500 MCM + 1 #3/0 EA CONDUIT SEE SHT 76-E-1

PROVIDE LONG SWEEP BENDS

MATCHLINE SEE SHEET 90-E-1

PRIMARY SEDIMENTATION BASIN
SEE SHEET 210-E-1

N

PLAN - EAST HALF

1" = 10'-0"

RECORD DRAWINGS

Revisions Drawn by MJ POPPLETON Date NOV 1993

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OREGON EXPIRES: 6/30/94 William F. Toole JULY 12 1974 WILLIAM F. TOOLE

CH2M HILL

DSGN TB JOYCE
DR L STOCKSLAGER
CHK W. F. TOOLE
APVD

NO.	DATE	REVISION	BY	APVD
6	11/2/93	CONTRACT C9 RECORD DRAWING	MJP	RCF
5	4/20/87	MISCELLANEOUS PLANT ADDITIONS CONTRACT C8 RECORD DRAWING	ROF	JGG
	9/30/86		JML	JBL
4	7/10/85	ADDENDUM NO. 5	VAP	JGG

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PIPE GALLERY ELECTRICAL PLAN
EAST HALF

SHEET 90-E-2
DRWG NO. 49 OF 440
DATE MAY 1989
PROJ NO. P 15600.A1

OVERLAY IDENTIFICATION
PROJ NO. P 15600.A1
CONTRACT
COMPOSITE
OVERLAY
SCREEN

FILM RE
4 SHT PRINTED
FORMAT 36 1 - 22 1/2 W.C.

NOTES:
1 CIRCUITS FROM MCC'S WHICH ARE DESIGNATED TYPE 1 OR TYPE G ARE TO BE ROUTED VIA CABLE TRAY 'TA'
2. FOR FEEDER DESCRIPTIONS TO MCC'S 2A & 2B, SEE SH 120-E-3.
3. FOR FEEDER DESCRIPTIONS TO MCC'S 3A & 3B, SEE SH 140-E-3

NOTE- PVC COATED CONDUIT USED IN WET WELL

WET WELL - CLASS I DIVISION I, GROUP D HAZARDOUS AREA

[3¼"C, 3-#12, 1-#12G] (CI 607)

GATE OPERATOR 510-1110

WET WELL

SF-620-1105 (CI 73)

MMP-650-1101

MCC-1B

UH-630-1101

WET WELL HOIST 380-1110 (CI 92)

[1½"C, 2#C TYPE 1] TO MCC-3A SC 610-1201, 1202

3/4"C, 6#12 TO MCC-3A

UH-630-1102

SERVICE SEE SITE PLAN SH 70-E-1 FOR CONTINUATION

SOURCE 1 MAIN CB.

TIE BREAKER

SOURCE 2 MAIN CB.

[½"C, TYPE 2]

TO MCC-1B

DOOR OPERATOR CONTROLS (CI 591)

DOOR OPERATOR

MCC-1A

LIA

[3½"C, 3#500MCM, 1#3G] TO SWBD-1

[¾"C, CONDUCTORS BY DOOR MFGR]

[1½"C, TYPE 2] TO CP-1

PNL LIA

[3"C-3#2/0+1#6G]

[3"C. 3#350MCM+1#3G]

[3"C. 3#2/0+1#6G]

CABLE TRAY TA

SC 110-1121 SC-110-1122 SC-110-1123 SC-110-1124 SC-110-1125

INFLUENT PUMP 110-1121 INFLUENT PUMP 110-1122 INFLUENT PUMP 110-1123 INFLUENT PUMP 110-1124 INFLUENT PUMP 110-1125

100 200 200 200 100 3

OTR S.P.HTR

CP-1

[3½"C, 3#500MCM, 1#3G. TO SWBD-1]

MCC-3B

MCC-1A

MCC-1B

ASU-620-1101 (CI 92)

MCC-3A

PNL L3A

MCC-2B

MCC-2A

PNL L2A

MCC-1A CP-1 SC-110-1121
MCC-2A SC-110-1122
MCC-3A SC-110-1124
LIA SC-110-1125

[½",12,C TYPE 1]
[2"C, 37/C TYPE 1]
[2"C, 37/C TYPE 1]

[¾"C, 5/C TYPE 1]

[3"C, 37/C, TYPE1, 25/C, TYPE 1] (CI 224) TO MCC-1A AT CHLORINE BLDG SEE SH 420-E-4

[¾"C, 4-#12, 2-#12G] (CI 224)

SF-620-1102

SF-620-1103

MMP-650-1101

[1½"C, TYPE 2]

[2-1"C, 3#8, 1#10G]

SC-610-1201
SC-610-1202

TROLLEY & HOIST 380-1120 (CI 72)

HEAVY CONCENTRATION OF EMBEDDED CONDUITS THIS AREA. SEE CONSTRUCTION PHOTOS FOR LOCATIONS OF CONDUITS.

[3"C. 3#2/0+1#6G]
SC-110-1121
SC-110-1122
[3"C. 3#350MCM+1#3G]
SC-110-1124
SC-110-1125
[3"C. 3#2/0+1#6G]

INSTALL AIR FILTERS ON INLET VENTILATION OPNGS OF ADJUSTABLE FREQUENCY CONTROLLERS

POWER PLAN EL 48.00
1/4" = 1'-0"

COMMUNICATIONS SYSTEM SERVICE FROM ADMIN BLDG SEE SH 70-E-1

MOUNT ONE ABOVE THE OTHER (CI 591)

THREE POSITION SELECTOR SWITCH, ENGRAVE NAMEPLATE "ON-OFF-PHOTOCELL"

MT. IN WET WELL AT ELEV. 45.00

MT 8'AFF

COMMUNICATIONS TJB-1

SEE SH 110-E-5 FOR CONTINUATION

½"C.O.

2"C.O. DOWN TO TJB-2 SEE SH 90-E-2

MT. 16'-0" A.F.F. (TYP) RELOCATED PER CI 527

RELOCATED PER CI 595

MT. 1'-0" ABOVE DOOR (TYP)

LIGHTING PLAN EL 48.00
1/4" = 1'-0"

N

RECORD DRAWINGS
Revisions Drawn by JM LOSTRA Date SEPT 1986

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REGISTERED PROFESSIONAL ENGINEER 5051 OREGON JULY 12, 1969 WILLIAM F. TOOLE

CH2M HILL

DSGN	TB JOYCE
DR	T.L. KIVETS
CHK	W.F. TOOLE
APVD	

NO.	DATE	REVISION	BY	APVD
(E)	4/20/87	MISCELLANEOUS PLANT ADDITIONS CONTRACT CB RECORD DRAWING	RCF JML	JGG JBL
(1)	7/1/83	ADDENDUM NO. 3	VAP	VKK

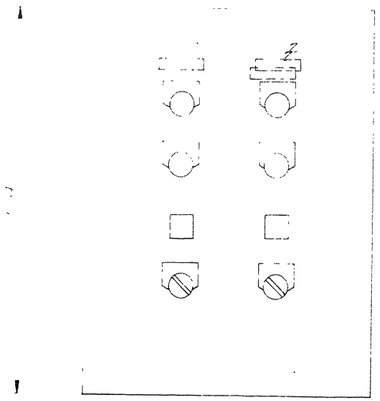
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

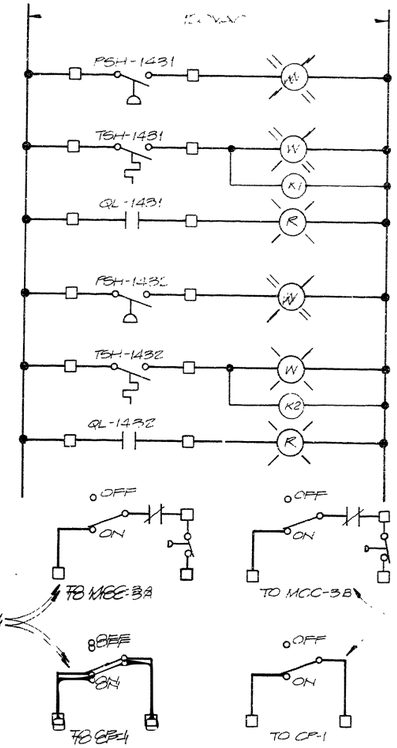
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

INFLUENT PUMP STATION MOTOR FLOOR
POWER PLAN AND LIGHTING PLAN

SHEET 110-E-4
DRG. NO. 650F436
DATE MAY 1983
PROJ NO. P 15600.A1

110-E-4
110-E-4.1
P15600A6 CB



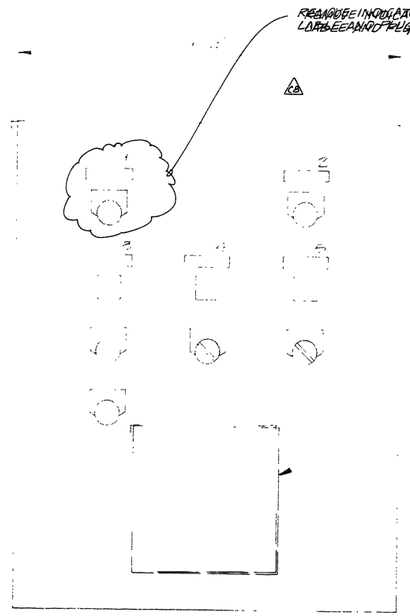


ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION FIRST LINE / SECOND LINE
1	PLH-1431[PRES] PLH-1431[TEMP] OLH-1431[TEMP] QR-1431[ON]	GRIT BLOWER NO. 1 / 220-1431
2	PLH-1432[PRES] PLH-1432[TEMP] OLH-2392[TEMP] QR-1432[ON] HS-1432 OO	GRIT BLOWER NO. 2 / 220-1432

PANEL SCHEDULE

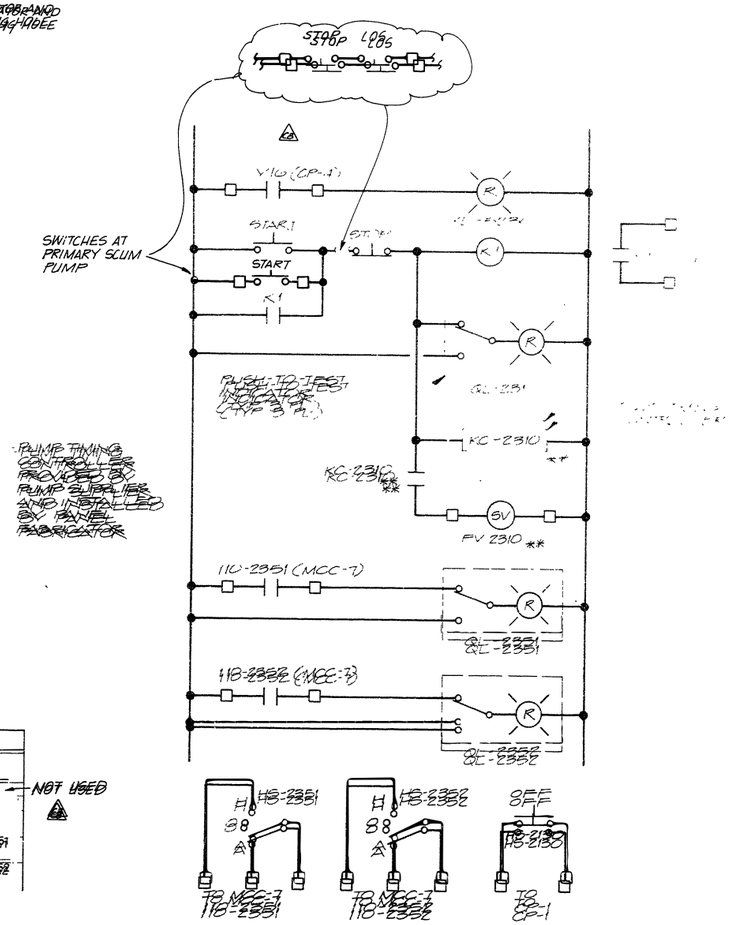
LOCAL PANEL LP-C1

NTS



ITEM NO.	TAG NO.	NAMEPLATE INSCRIPTION FIRST LINE / SECOND LINE
1	XL-5230[ON]	FLOAT THICKENER / STATUS
2	HS-2130[OFF]	SCUM COLLECTOR / OVERRIDE
3	QL-2310[ON] HS-2310[SS]	SCUM PUMP / 130-2310
4	QL-2351[ON] HS-2351[HOA]	SCUM UNDERFLOW / PUMP 110-2351
5	QL-2352[ON] HS-2352[HOA]	SCUM UNDERFLOW / PUMP 110-2352

NOT USED



LOCAL PANEL LP-S1

NTS

NOTE: SEE C.I. TABLE FOR CONNECTION OF RUN INDICATOR LIGHTS

RECORD DRAWINGS

Revised per ECO's dated ... SEPT 1986

THESE RECORD DRAWINGS WERE PREPARED, IN PART, ON THE BASIS OF INFORMATION FURNISHED TO CH2M HILL BY OTHERS. CH2M HILL DOES NOT WARRANT THE COMPLETENESS OR ACCURACY OF SUCH INFORMATION. CH2M HILL ASSUMES NO RESPONSIBILITY FOR ANY ERRORS OR OMISSIONS WHICH MAY BE INCORPORATED INTO THE RECORD DRAWINGS AS A RESULT OF SUCH INFORMATION.

REGISTERED PROFESSIONAL ENGINEER 11,831 Harold L. Slatter OREGON JULY 18 1982 HAROLD L. SLATTER

NO.	DATE	REVISION	BY	APVD
3	4/20/87	MISCELLANEOUS PLANT ADDITIONS CONTRACT C8 RECORD DRAWING	RCF JML	JGG JBL
2	9/25/86			

CH2M HILL

DSGN J. SLATTER
DR Larry Lago
CHK Frank M Boland
XPVD James Keary

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

LOCAL PANELS LP-C1 & LP-S1
LOCAL PANELS LP-C1 & LP-S1

SHEET 140-N-3
DWG NO. 116 OF 4916
DATE MAY 1983
PROJ NO. P 15600.A1

OVERLAY IDENTIFICATION
COMPOSITE 140-N-3 | 140-N-3.1
OVERLAY 140-N-3 | 140-N-3.1
SCREEN 5
PROJ NO.
CONTRACT

PRIMARY SED BASIN MOTORIZED BY-PASS GATE 510-2140 (CI 98)

[4-3/4"C, 2/C #10 TYPE 6, 13-3/4"C, 2/C #12 TYPE 6] TO MCC 7A & CHLORINE BLDG

LP-S1 (CI 475) MOUNT ON HANDRAIL

[1"C, 12/C TYPE 1] TO MCC-7A & 7B @ CHLORINE BLDG. VIA CABLE TRAY 'TB' SEE SH 90-E-1&2

[1"C, 3/C #12, TYPE 6 + 5/C TYPE 1] TO MMP-650-4201 VIA PULL BOX #4

[1/2"C, 2 #10, 1 #10G] TO PNL L7B VIA PULL BOX #4

UH-630-2101 *

PULL BOX #4

TO PNL L7B VIA PULL BOX #4

HELICAL SCUM COLLECTOR 350-2131 TO PNL L7B VIA PULL BOX #4

TO SC-610-2101 & SC-610-2102 CHLORINE BLDG VIA CABLE TRAY 'TB'

[3/4"C, 3/C #12 TYPE 6]

* EF-610-2101 (CI 92)

* EF-610-2102

UH-630-2108 (30 KW)

[1 1/4"C, 3/C #8 TYPE 6]

TO PNL L7B VIA PULL BOX #4

HELICAL SCUM COLLECTOR 350-2132

[1"C, 3/C #12 TYPE 6 + 5/C #12 TYPE 1]

[2 1/2"C, 3/C #350 MCM TYPE 6] TO MCC-4A,4B,7A & 7B VIA CABLE TRAY 'TB'

300A CB BLDG DISCONNECTS

[1/2"C, 2#10, 1#10G]

COMMUNICATIONS TJB-7

COMMUNICATIONS SYSTEM AMPLIFIER

COMMUNICATIONS SYSTEM POWER SUPPLY

2"C.O. TJB-6

TO MMP-650-4201 VIA PULL BOX #4

UH-630-2102 *

HELICAL SCUM COLLECTOR 350-2133

[1"C, 3/C #12 TYPE 6 + 5/C #12 TYPE 1]

TO PNL L7B

TO MMP-650-4201 @ CL2 BLDG

MT 10' AFF (TYP OF 2) (CI 661)

3/4" C.O. TO AMPLIFIER

[1 1/4"C, 3/C #8 TYPE 6]

TO PNL L7B VIA PULL BOX #4

+14'-0"±

INSTALL WALL MOUNTED DUAL SET POINT THERMOSTAT W/ TIMER TO CONTROL UH-610-2105, 6 & 7 WEATHER STATION

3/4" C.O. TO AMPLIFIER

UH-630-2106 (30 KW)

HELICAL SCUM COLLECTOR 350-2134

MT 8' AFF (CI 621)

[1"C, 3/C #12 TYPE 6 + 5/C #12 TYPE 1]

PRIMARY EFFLUENT SAMPLER 350-2180

[1/2"C, 2#10, 1#10G]

UP

HELICAL SCUM COLLECTOR 350-2135

[1/2"C, 2#10, 1#10G]

TO MMP-650-4201 VIA PULL BOX #4

UH-630-2103 *

[1 1/4"C, 3/C #8 TYPE 6]

UH-610-2107 (30 KW)

[1"C, 3/C #12 TYPE 6 + 5/C #12 TYPE 1]

HELICAL SCUM COLLECTOR 350-2136

MOUNT 2' ABOVE DOOR (TYP)

TO MMP-650-4201 PULL BOX #4

UH-630-2104 *

MOUNT 11' AFF TYP OF 8 (CI 661)

EMBEDDED CONDUIT COMBINED INTO ONE CONDUIT TYP

TORQUE OVERLOAD (TYP 6 PLACES)

INSTALL @ TOP OF STAIRS

TO MCC 7A&7B @ CHLORINE BLDG. VIA CABLE TRAY 'TB', SEE SH 90-E-2.

PRIMARY SLUDGE COLLECTOR, 340-2111

TO PNL L7B VIA PULL BOX #4

[1/2"C, 3/C #12, TYPE 6 + 7C TYPE 1]

FWD-OFF-JOG (REV) SWITCH TYP OF 6 (FURNISHED BY SLUDGE COLLECTOR MFR) MOUNT ENCLOSURE ADJACENT TO PUSHBUTTON STATION ENCLOSURE ON A COMMON BACKBOARD (CO #8)

[1/2"C, 2#10, 1#10G]

PRIMARY SLUDGE COLLECTOR 340-2112

PRIMARY SLUDGE COLLECTOR 340-2113

[1 1/2"C, 3/C #12 TYPE 6 + 7/C, TYPE 1]

SEE DET (600) (TYP)

PRIMARY SLUDGE COLLECTOR 340-2114

3/8" C.O. TO EDGE OF SLAB FOR GROUNDING WEATER STATION

FOR CONTINUATION SEE SH 140-E-1

[1/2"C, 2#10, 1#10G]

PRIMARY SLUDGE COLLECTOR 340-2115

[1 1/2"C, 3/C #12, TYPE 6 + 7/C TYPE 1]

PRIMARY SLUDGE COLLECTOR 340-2116

NOTE- CONDUIT LOCATED OUTSIDE OF BLDG TO BE EMBEDDED. SEE CONST PHOTOS FOR APPROX LOCATION OF CONDUITS.

* FOR EXACT LOCATIONS SEE SH 210-H-1

RECORD DRAWINGS
Revisions Drawn by MJ POPPLETON Date OCT 1993
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PRIMARY SEDIMENTATION BASIN ELECTRICAL PLAN

1/8" = 1'-0"

NO.	DATE	REVISION	BY	APVD
2	10/15/93	RECORD DRAWING	MJP	RCF
2	6/90	MISCELLANEOUS PLANT ADDITIONS CONTRACT C9	JAS	RCF
2	10/3/86	RECORD DRAWING	JML	JBL
1	7/1/83	ADDENDUM NO. 3	VAP	VAP

DSGN TB JOYCE
DR L. STOCKSLAGER
CHK W. F. TOOLE
APVD

CH2M HILL

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING. 0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

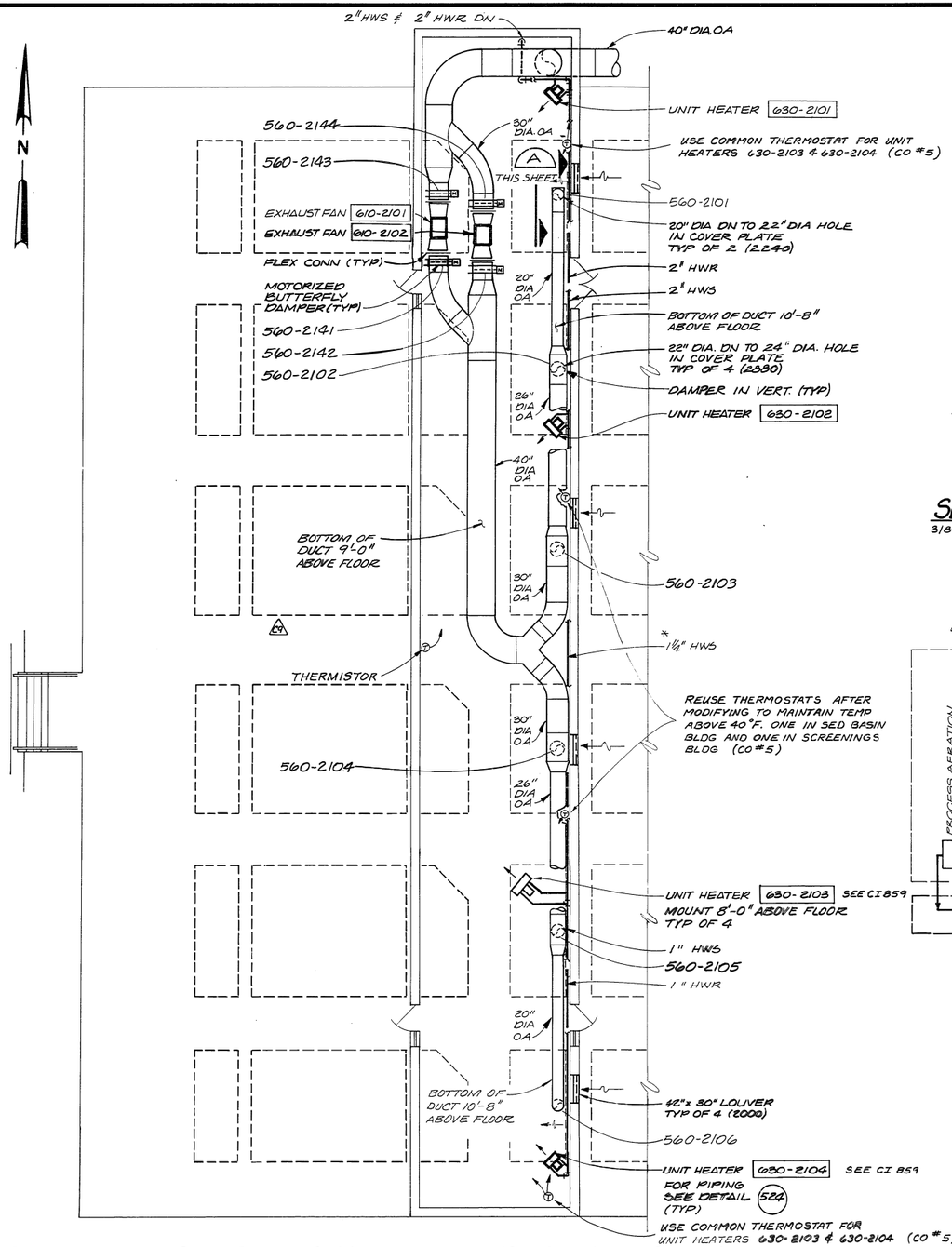
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION ELECTRICAL PLAN

SHEET 210-E-1
DWG. NO. 139 OF 436
DATE MAY 1983
PROJ NO. P 15600.A1

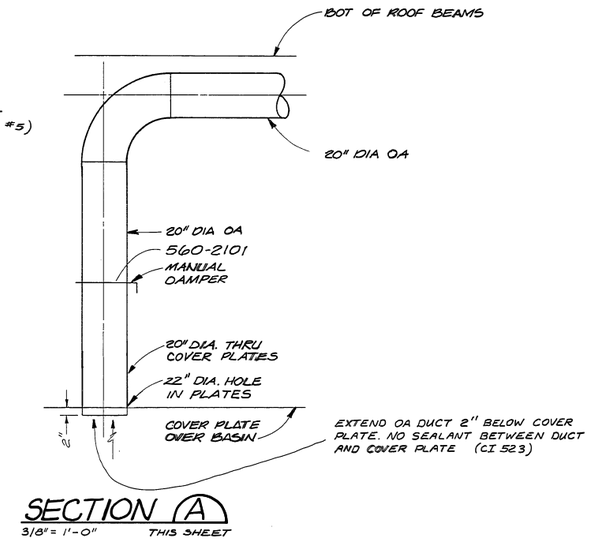
William F Toole OREGON JULY 12, 1983 WILLIAM F TOOLE

FILM KE 3 DM PRINTED 10 82 AZ
FORMAT 381-2334 DC
210-E-1.1
210-E-1.1
1/8"=1'-0"
P15600 C7 C9



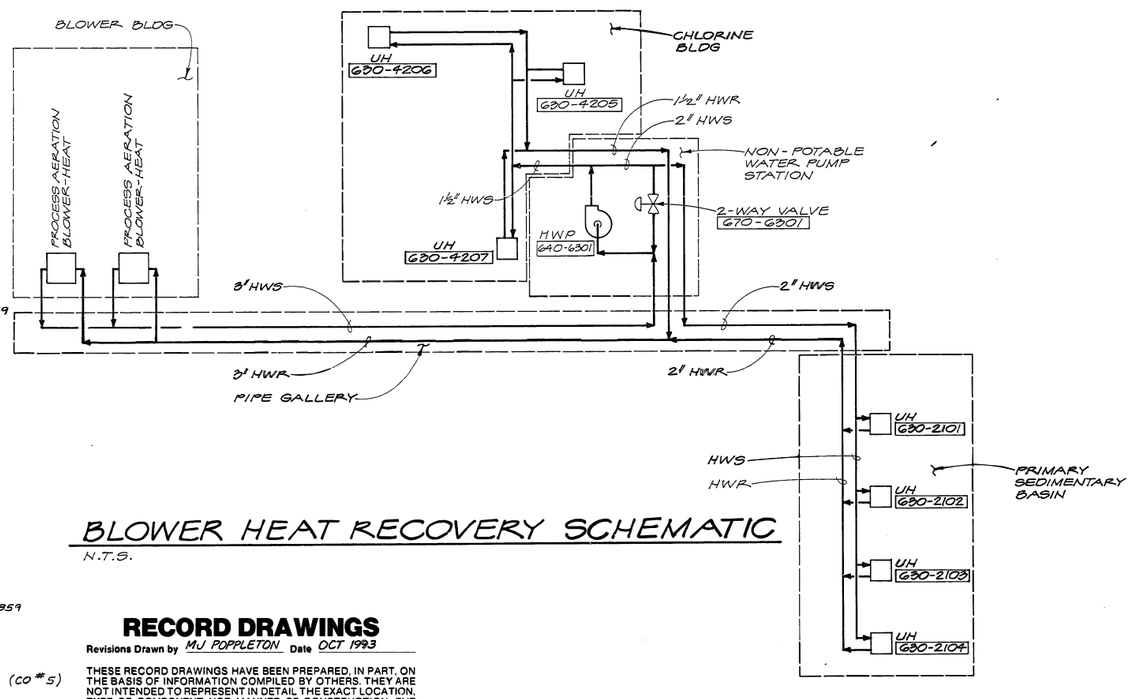
PRIMARY SEDIMENTATION BASINS-PARTIAL PLAN

1/8" = 1'-0"



SECTION A

3/8" = 1'-0" THIS SHEET



BLOWER HEAT RECOVERY SCHEMATIC

N.T.S.

RECORD DRAWINGS

Revisions Drawn by MJ POPPLETON Date OCT 1993

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REGISTERED PROFESSIONAL ENGINEER 8334 OREGON APRIL 13, 1979 HENRY R. GEOGHEGAN

CH2M HILL

DSGN D. Hinds
DR O. BALLARD
CHK Henry R. Geoghegan
APVD James M. Scott

NO.	DATE	REVISION	BY	APVD
4	10/5/93	RECORD DRAWING	MJP	RCF
3	6/90	MISCELLANEOUS PLANT ADDITIONS CONTRACT 09	JAS	RCF
2	10/3/86	RECORD DRAWING	JML	JBL

VERIFY SCALES
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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN
HVAC UPPER LEVEL PLAN

SHEET 210-H-1
DWG. NO. 130 OF 430
DATE MAY 1983
PROJ NO. P 15600.A1

OVERLAY IDENTIFICATION
PROJ NO.
CONTRACT
COMPOSITE
OVERLAY
SCREEN
210-H-1.1
210-H-1.4

FILM KC 4 SMUT PRINTED 8 82 FORMAT 381-2231MC

RECORD DRAWINGS
Revisions Drawn by MJ POPPLETON Date AUG 1993

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N

10"WS, ℄ EL 45.66 — FOR CONTINUATION SEE SH 90-M-2 — 2" LAUNDER DRAIN TO SCUM BOX (CI 228) — 8'-0" ± — PRIMARY SCUM BOX AREA, SEE DETAIL 2 / 210-M-4 — FOR DETAIL THIS AREA SEE 1 / 210-M-3

FLEXIBLE FLAPGATE (CI 92) — 510-2140 MOTORIZED BY-PASS GATE W/ SELF CONTAINED FRAME — FCG 2140 — 10" WS — 510-2181 — BY PASS LAUNDER

7'-6"± (CI 688) — ℄ EL. 51.00 — PLUG EXISTING HOLE w/CAPPED 2" PVC PIPE (CI 688 & 633)

(CI 688 CORE DRILL HOLE DIA AS REQD USE LINK-SEAL SIM DET 393 TYP 3 LOCATIONS. INVT EL OF CONNECTION TO SCUM BOX IS 44.00. SLOPE UNIFORMLY UP 0.01 TO NORTH WALL PENETRATION @ BASIN 1.

2'-9" TYP

ADD RAILS TO SLUDGE HOPPER PER CI 106

SLUDGE COLLECTOR FLOOR RAILS SEE 210-S-8

351 (TYP OF 8) — INSTALL SHEAR GATE, 8"-V900 TYP OF 2, SEE DETAIL 4 / 210-M-5 — ℄ EL. 51.06 — 90-M-11

BASIN 1 AT EL 40.00

560-2131

4" W4 — 2" W2 (CI 321)

1½" W4 HV-6 SEE 393

BASIN 2 AT EL 46.00

TYPE 'B' HOSE RACK SEE 392

560-2132 — FLEXIBLE FLAPGATES TYPICAL @ 24 LAUNDERS — 1'-6" — ℄ EL. 51.15 — H / 210-M-3 — PAINT SKIMMER BEACHES, TYP OF 6, SEE DETAIL 2 / 210-M-2

3"W3 — 392

FOR DETAIL THIS AREA SEE 1 / 210-M-4 — 32'-9" — 4"D (TYP 6) — 560-2133 — ℄ EL. 51.24 — 30'-0" — 5'-0" TYP 6

HELICAL SKIMMER (TYP 6) 350-2133 — HR — 392 — 90-M-11 — B / 210-M-4

BASIN 3 AT EL 53.00 — 1½" W4 HV-6 SEE 393

1'-6½" (TYP) — 4"D TYP

1½" RISER W4 TO HV 393 (TYP 3 OF 3) *

PRIMARY EFFLUENT SAMPLER 350-2130 — E / 210-M-3 — 350-2134 — FD-3 — 2" UP TO RD-1 (TYP 4) SEE NOTE 3 — HELICAL SKIMMER DRIVE (TYP 6) 350-2135 — FOR DETAIL AREA SEE 3 / 210-M-5 — 560-2134 — D / 210-M-2 — FCO

HV-393 — FD-2 — (CI 550) — BASIN 4 (BELOW) — FD-2 — 3"W4 — 2"W2 (CI 321) — (CI 446 & 656)

TYPE 'B' HOSE RACK SEE 392 — BENT ALL-THREAD ROD USED TO MOUNT DRIVES (CI 643 a)

A / 210-M-2 — 360-2135 — FD-3 — 4" D TYP — TERMINATE w/ DISCHARGE INTO BASIN 5"±6" BELOW FLOOR TYP (CI 446 & 656) — FLOOR VALVE BOX FOR SHEAR GATE, TYP OF 2 SEE DETAIL 4 / 210-M-5 — 210-M-1.1 / 210-M-1.1

BASIN 5 (BELOW) — FD-2 — HV-395 TYP — (CI 321) — 1½" W4 HV-6 SEE 393 — F / 210-M-3 — 90-M-11 — HR — 392 TYP 6 — 2" UP TO RD-2

360-2136 — 210-M-5 — FD-3 — 510-2186 — 0.9' TO CLR WS — 13"RD — 350-2136 — 2" W2 (CI 321)

BASIN 6 (BELOW) — FD-2 — 4" D (TYP) — FCO — 3" W4 — FLOOR VALVE BOX FOR W-5 FLUSHING WATER (TYP OF 6) — 385 — 3" W3 ℄ EL 43.25 FOR CONT SEE SHT 320-M-2

B / 210-M-2 — SCUM CHANNEL FLUSHING WATER, SEE DET 3 / 210-M-2 (PR 30, C04)

GATE 510-2111 — GATE 510-2112 — GATE 510-2113 — GATE 510-2114 — GATE 510-2115 — GATE 510-2116 — GATE 510-2117 — GATE 510-2161 — GATE 510-2162 — GATE 510-2116 — FD-2

8'-0" TYP — 12" TYP — 10"D — 8'-0" 20 TYP — 8'-0" TYP

TYPE 1 — 560-2111 — LSH 2161 — 6"ALP (CI 512) — 560-2112 — 560-2113

FOR CONTINUATION SEE SH 90-M-2

8"D — 6"D — 4" SSM — 2" W-2 — 4" ALP — 4" SEP — 560-2114 — 2"W3 — 560-2115 — 6"x4" REDUCER (CI 512) — 4"ALP — 560-2116 — 560-2117

SEE DETAIL PLAN 1 / 210-M-1

SCREENINGS BUILDING SEE SH 120-M-1 — M / 210-M-5

336 SIM. — PROVIDE SPRAY NOZZLE W/ 3/4" BALL VALVE AT INLET TO EACH SEDIMENTATION BASIN & AT EACH END OF THE CHANNEL.

DOUBLE WALL PIPE PENETRATION PER CI 290

340-2114 — 560-2118 — 4" PSM UNDERFLOW — 560-2119 — PRIMARY GALLERY BELOW SEE SH 90-M-2

590-2363 — SLUDGE COLLECTOR DRIVE (TYP 6) 340-2115 — GATE 510-2161 — 4" PSM (CI 444) UNDERFLOW

LSH 2162 — A / 210-M-2 — 560-2120 — GATE 510-2162 — 560-2121 — GRIT CHAMBERS SEE SH 140-M-1

J / 210-M-3 — C / 210-M-2 — 2"W3 — 7'0" — 10"D — I / 210-M-3 — CHANNEL DIFFUSER HEADER — TYPE 3 (TYP OF 6)

340-2116 — HR — 392 (TYP) — 560-2122 — 4"ALP — 560-2123 — TYPE 1

GATE 510-2116 — -SG-1 TYP — DETAIL THIS AREA SIMILAR TO I / 210-M-3 — L / 210-M-5

HSG-1 — 305 TYP OF 24 — SLIDE GATE SLOTS TYP 24 PLACES. PROVIDE 8 GATES — 3'-6" (TYP)

EL. 54.00 — 6" — 12" — 510-2113 BASIN ISOLATION GATE — EL. 44.75 — SLOPE — 4"D INVT EL 45.50 — A0

EL. 44.73 — 2'-6" — 4'-0" — 3'-0" — 4'-0" — EL. 51.20 — 3'-0" — 3'-0" — EL. 43.75

PRIMARY SEDIMENTATION BASIN INLET DETAIL PLAN 1 / 210-M-1

3/8"=1'-0"

NOTES:

1. LOCATE DRIVE & EQUIPMENT ATTACHMENTS, FLOOR AND WALL OPENINGS FOR SLUDGE COLLECTORS AND SKIMMERS PER MANUFACTURERS RECOMENDATIONS.
2. ALL SIX PRIMARY SEDIMENTATION BASINS ARE SIMILAR. BASINS 1,2,&3 SHOWN WITHOUT COVER SYSTEM. BASIN 4,5,&6 SHOWN WITHOUT SKIMMER AND COLLECTOR EQUIPMENT.
3. FOR ROOF DRAIN LOCATIONS SEE SH. 210-A-2 DELETE DOWNSPOUT PENETRATIONS THROUGH PRE-CAST WALL PANELS AND ROUTE DOWN INSIDE FACE OF WALL DIRECT TO THE PRIMARY SED BASIN. TERMINATE DOWNSPOUT @ EL 48.50 (CI 44)
4. (CI 225) 304 SST ADHESIVE ANCHOR BOLTS FOR PRIMARY SED BASIN MECHANISM TO BE USED EXCEPT ANCHORS FOR PRIMARY SED BASIN MECHANISM DRIVE MACHINERY WHICH SHALL BE EMBEDDED ANCHORS.
5. ALP PIPING MATERIAL TO BE TYPE 304 SST IN PRIMARY SED BASIN, ALL OTHER AREAS ACCORDING TO BR #86.

* THERMAL VALVE NOT REQD. PROVIDE GALLERY MOUNTED MANUAL SHUT-OFF & DRAIN ONLY (CI 894)

6. TAPE WRAP NEW COPPER W4 PIPING IN ACCORDANCE WITH SYSTEM NO. 30 AS SPECIFIED IN SECTION 09900.

PRIMARY SEDIMENTATION BASIN PLAN

1/8"=1'-0"

REGISTERED PROFESSIONAL ENGINEER 8254 OREGON SEPT. 20, 1974 DONALD C. WRIGHT

CH2M HILL	
DSGN DC Wright	
DR T.K. CROCKER	
CHK J.G. FOOS	
APVD	

NO.	DATE	REVISION	BY	APVD
A	8/26/93	RECORD DRAWING	MJP	RCF
	10/90	MISCELLANEOUS PLANT ADDITIONS - CONTRACT 09	MJM	RCF
	10/28/86	RECORD DRAWING	JML	JBL

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

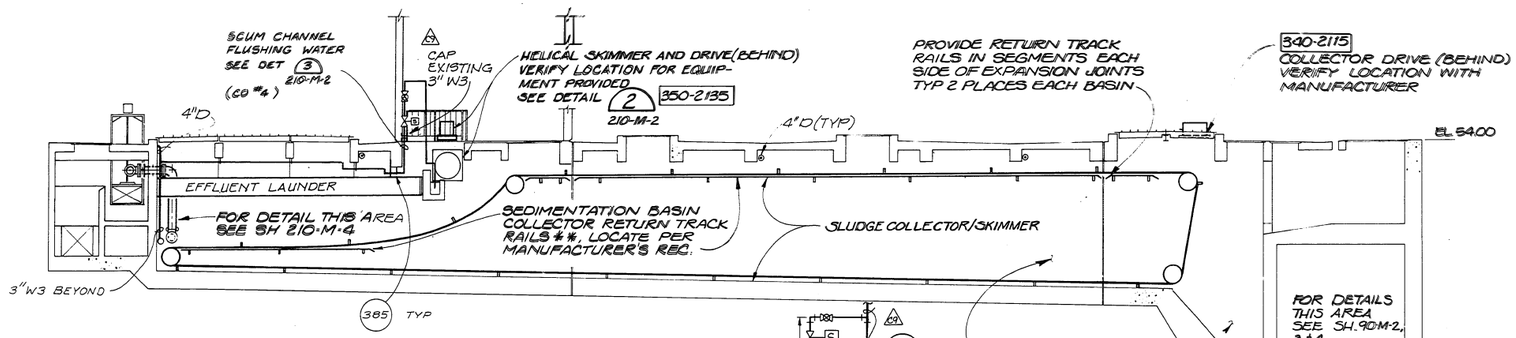
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

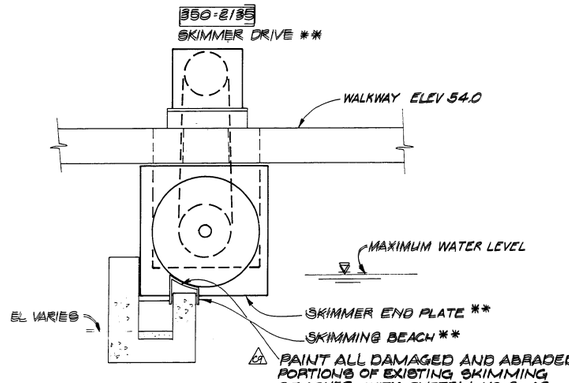
PRIMARY SEDIMENTATION BASIN MECHANICAL PLAN

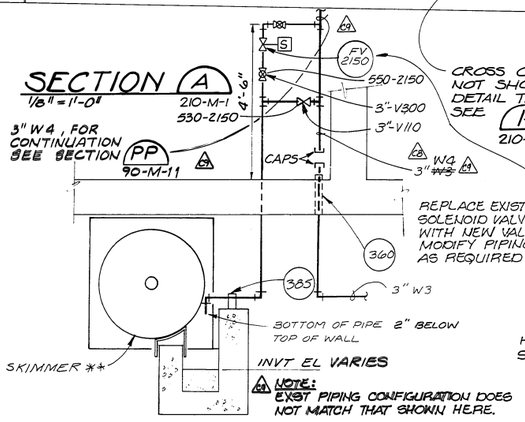
SHEET 210-M-1
DWG. NO. 133 OF 430
DATE MAY 1983
PROJ NO. P 15600.A1

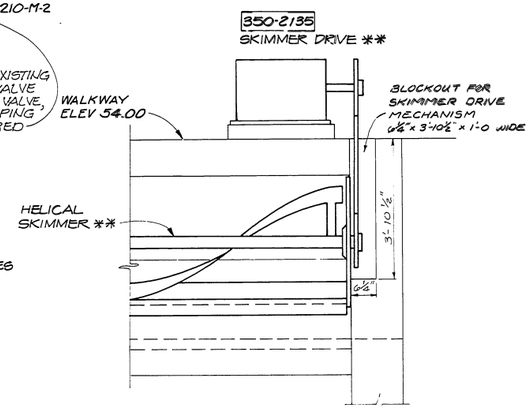
FILM KE — FORMAT 381-2324-MC — SMUT PRINTED — A2 — A1

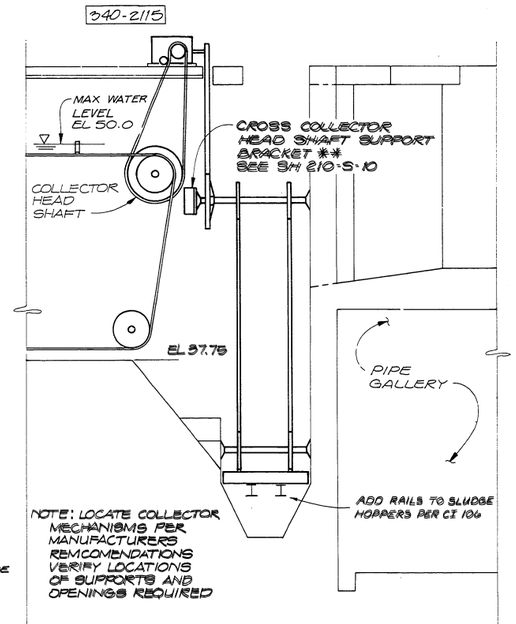
OVERLAY IDENTIFICATION — COMPOSITE — OVERLAY — SCREEN
PROJ NO. — CONTRACT











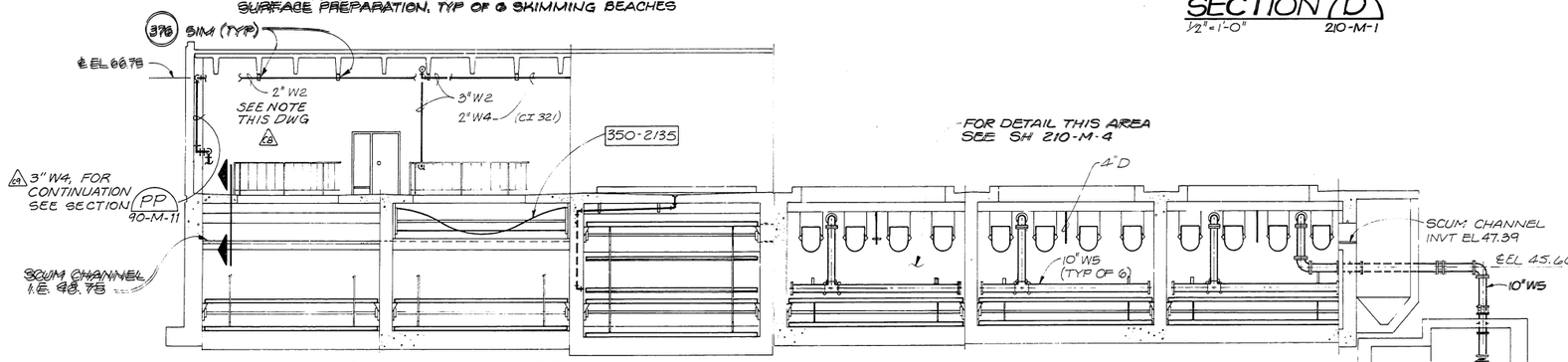
DETAIL 2
1/2" = 1'-0" 210-M-2 210-M-4

DESIGN RE Wright
DR KJ DICKGIESSER
CHK JG FOSS
APVD Ronald C. Wright

1. PAINT ALL DAMAGED AND ABRADED PORTIONS OF EXISTING SKIMMING BEACHES WITH SYSTEM NO. 2 AS SPECIFIED IN SECTION 09900. PREPARE SURFACES IN ACCORDANCE WITH SPECIFICATION SECTION 09900, PARAGRAPH 3.10.7. CONTRACTOR SHALL PROTECT EQUIPMENT AND TANKAGE FROM SANDING, DUST, CHIPPED PAINT AND OTHER BYPRODUCTS OF WORK. CLEAN SEDIMENTATION BASINS OF DEBRIS CAUSED BY SKIMMING BEACH SURFACE PREPARATION. TYP OF 6 SKIMMING BEACHES

SCUM CHANNEL FLUSHING WATER
(ONE PLACE ONLY)

DETAIL 3
1/2" = 1'-0" 210-M-2



SECTION B
1/8" = 1'-0" 210-M-4

SECTION D
1/2" = 1'-0" 210-M-1

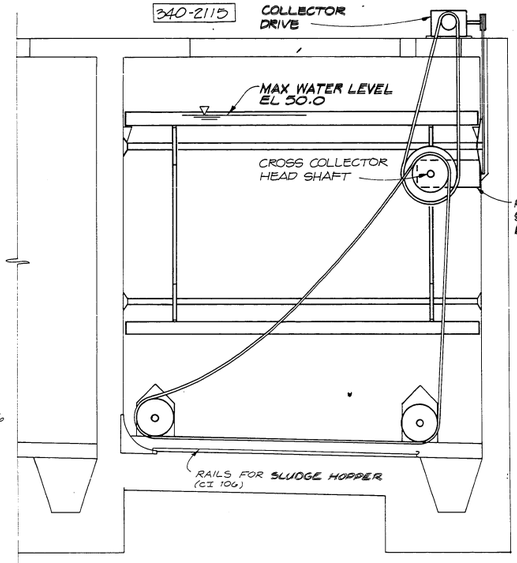
RECORD DRAWINGS

Revisions Drawn by MJ POPPLETON Date OCT 1993

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

** EQUIPMENT SUPPLIED WITH MECHANISMS

NOTE: TAPE WRAP ALL EXISTING AND NEW EXPOSED COPPER PIPING AND FITTINGS INSIDE THE PRIMARY SEDIMENTATION BUILDING IN ACCORDANCE WITH SYSTEM NO. 30 OR SYSTEM NO. 31 AS SPECIFIED IN SECTION 09900.



DETAIL 1
1/4" = 1'-0" 210-M-2

SECTION C
1/4" = 1'-0" 210-M-1

REGISTERED PROFESSIONAL ENGINEER 8254 OREGON SEPT. 20, 1974 DONALD C. WRIGHT

NO.	DATE	REVISION	BY	APVD
3	10/1/93	RECORD DRAWING	MJP	RCF
2	10/1/90	MISCELLANEOUS PLANT ADDITIONS CONTRACT C9	GPD	ROF
1	4/20/87	MISCELLANEOUS PLANT ADDITIONS CONTRACT C8	RCF	JGF
	10/3/86	RECORD DRAWING	JML	JBL

CH2M HILL

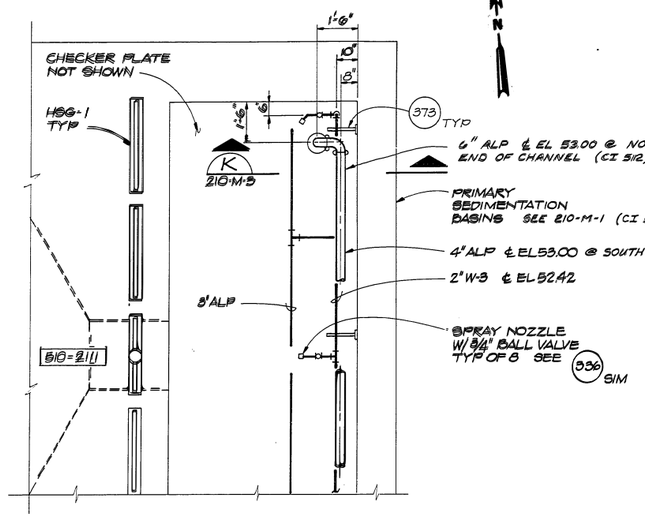
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

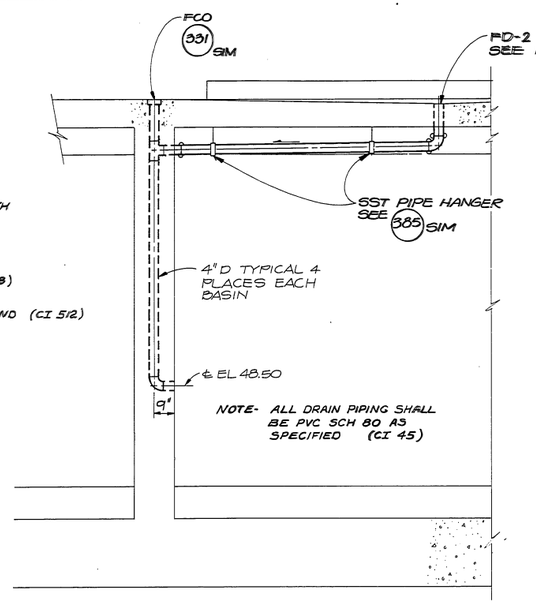
PRIMARY SEDIMENTATION BASIN SECTIONS

SHEET 210-M-2
DWG. NO. 194 OF 490
DATE MAY 1993
PROJ NO. P 15600.A1

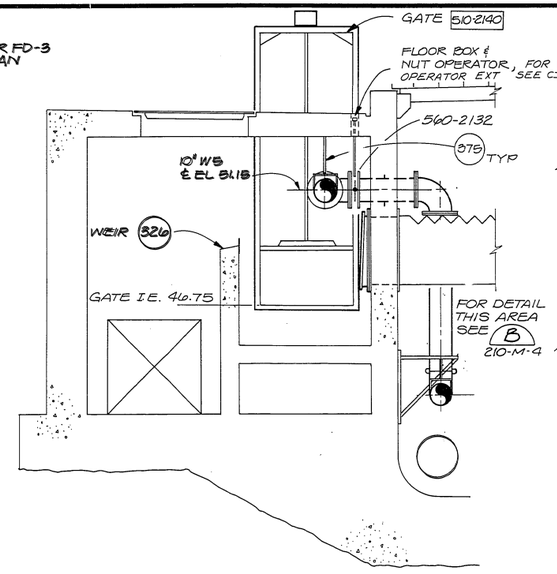
FILM KE 3 DM PRINTED 10 02 AZ
FORMAT 351-2234 OC
210-M-2 210-M-4 210-M-2.1 210-M-2.2
P15600.00 GPC 02-93



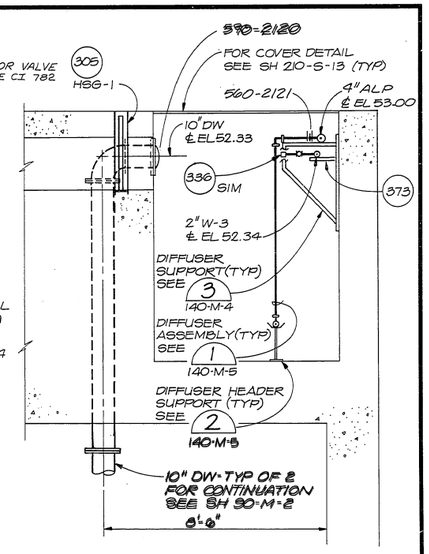
PARTIAL PLAN 1
3/8"=1'-0" 210-M-1



SECTION F
3/8"=1'-0" 210-M-1

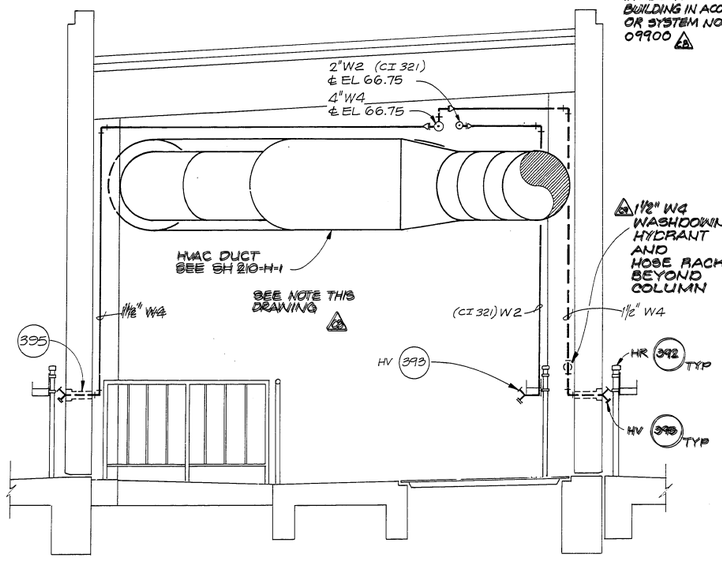


SECTION H
3/8"=1'-0" 210-M-1

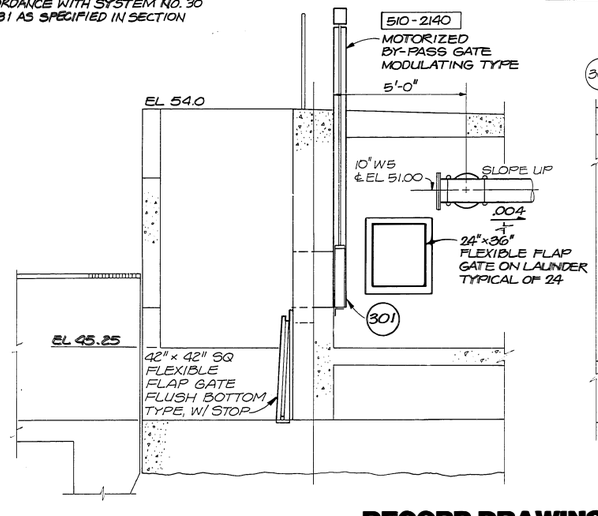


SECTION I
3/8"=1'-0" 210-M-1

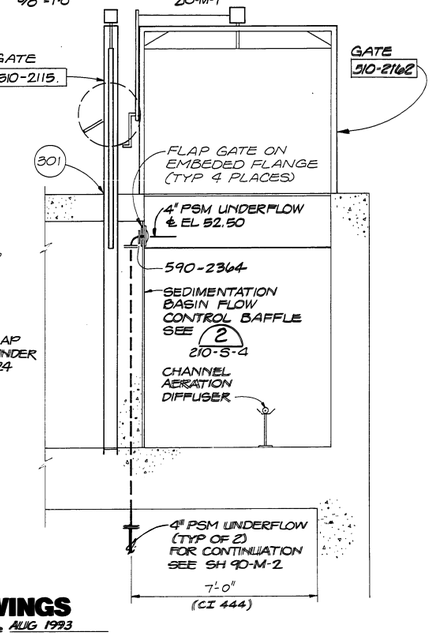
NOTE:
TAPE WRAP ALL EXISTING AND NEW EXPOSED COPPER PIPING AND FITTINGS INSIDE THE PRIMARY SEDIMENTATION BUILDING IN ACCORDANCE WITH SYSTEM NO. 30 OR SYSTEM NO. 31 AS SPECIFIED IN SECTION 09900 A



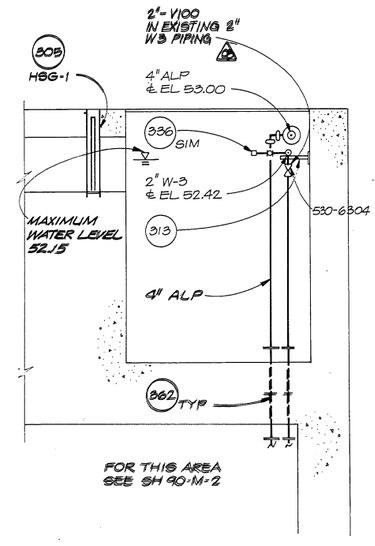
SECTION E
3/8"=1'-0" 210-M-1



SECTION G
3/8"=1'-0" 210-M-1



SECTION J
3/8"=1'-0" 210-M-1



SECTION K
3/8"=1'-0" 210-M-3

RECORD DRAWINGS
Revisions Drawn by MJ POPPLETON Date AUG. 1993

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

REGISTERED PROFESSIONAL ENGINEER 8254 OREGON SEPT. 20, 1974 DONALD C. WRIGHT

CH2M HILL

DSGN	
DR	C.J. BROWN
CHK	J.G. FOSS
APVD	

NO.	DATE	REVISION	BY	APVD
A	8/26/93	RECORD DRAWING	MJP	RCF
28	10/19/90	MISCELLANEOUS PLANT ADDITIONS CONTRACT C9	RCF	RCF
	4/20/87	MISCELLANEOUS PLANT ADDITIONS CONTRACT C8	RCF	JGG
	10/3/86	RECORD DRAWING	JML	JBL

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

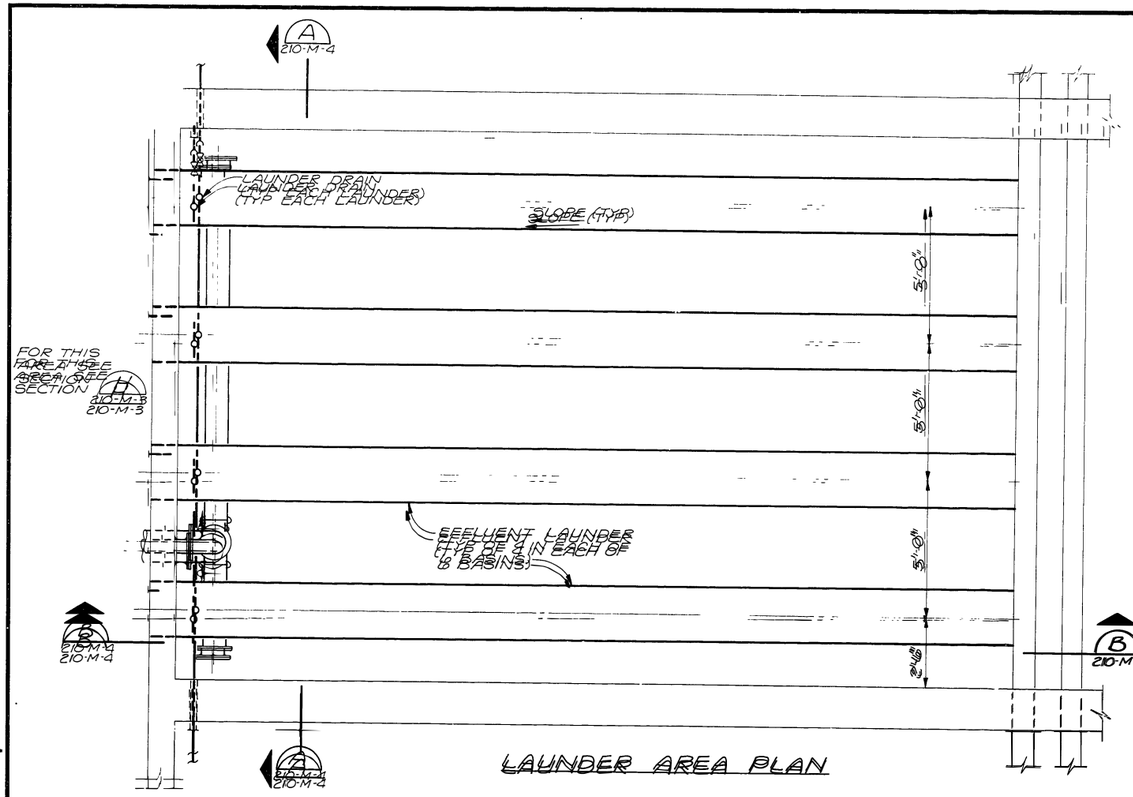
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN
MECHANICAL SECTIONS

SHEET	210-M-3
DWG. NO.	135 OF 496
DATE	MAY 1983
PROJ NO.	P 15690.A1

210-M-3 210-M-3.1
210-M-3 210-M-3.1

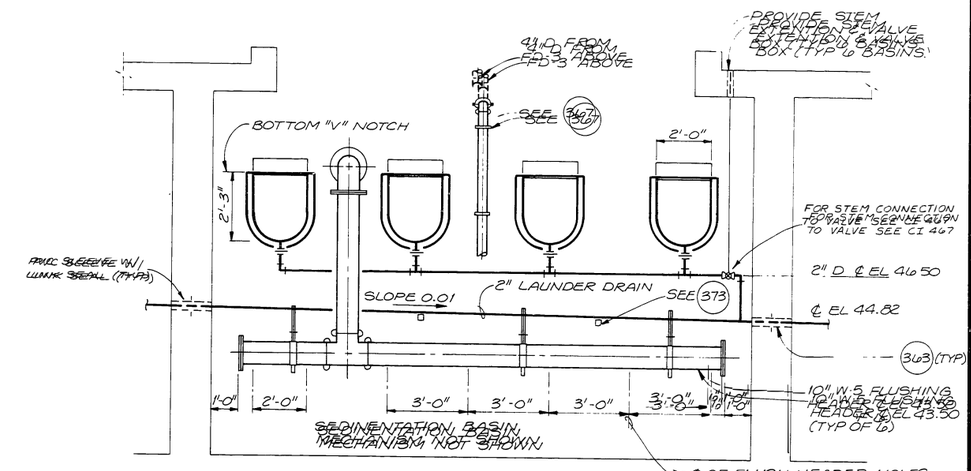
FILM KE 3 DM PRINTED 10 82 AZ
FORMAT 381-2234 DC



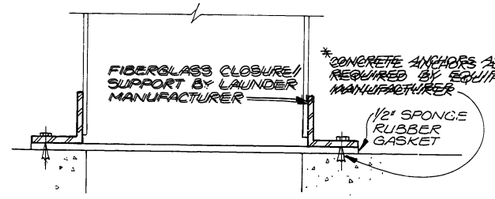
LAUNDER AREA PLAN

DETAIL 1
3/8" = 1'-0" 210-M-1

SECTION B
3/8" = 1'-0" 210-M-4

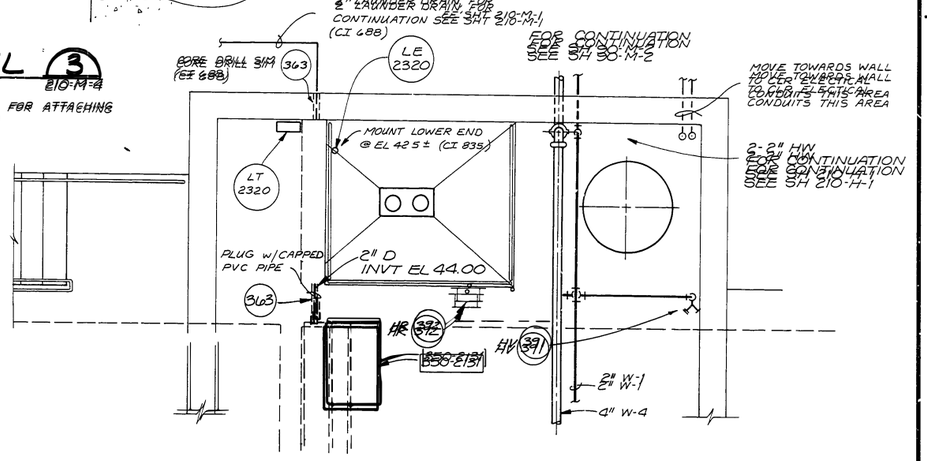


SECTION A
3/8" = 1'-0" 210-M-4



DETAIL 3
NTS 210-M-4

* SST WEDGE ANCHORS FOR ATTACHING FIBERGLASS (CR 37)



PRIMARY SCUM BOX PLAN

DETAIL 2
3/8" = 1'-0" 210-M-1

RECORD DRAWINGS

Revisions Drawn by JIM WOESTRA Date OCT 1986

THESE RECORD DRAWINGS HAVE BEEN PREPARED IN PART ON THE BASIS OF INFORMATION FURNISHED BY OTHERS. THEY ARE NOT INTENDED TO BE PRECISION TRACINGS AND THE ENGINEER DOES NOT WARRANT THE CORRECTNESS OF DIMENSIONS OR LOCATIONS OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

REGISTERED PROFESSIONAL ENGINEER 8254 OREGON SEPT. 20, 1974 DONALD C. WRIGHT

CH2M HILL

DSGN DESIGN
DR DRAFTING
CHK CHECKED
APVD APPROVED

NO.	DATE	REVISION	BY	APVD
	10/86	RECORD DRAWINGS	JWW	

VERIFY SCALES
BAR IS 1 INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

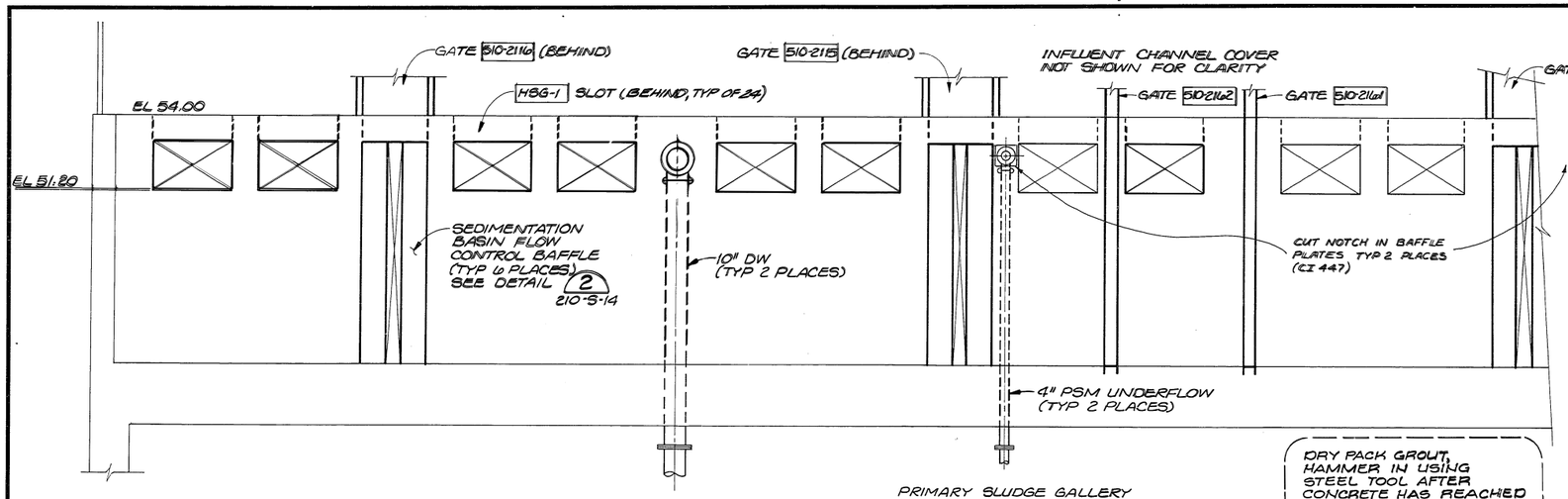
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN
PRIMARY SEDIMENTATION BASIN
MECHANICAL SECTIONS & DETAILS
MECHANICAL SECTIONS & DETAILS

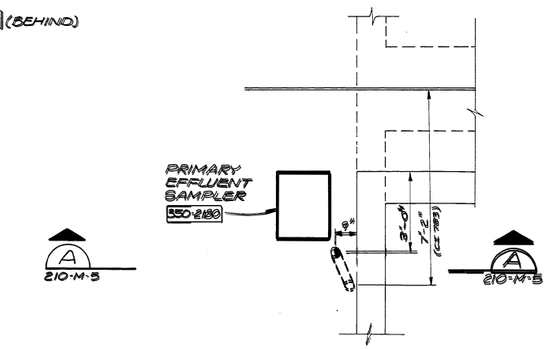
SHEET 210-M-4
DWG. NO. 136 OF 270
DATE MAY 1983
PROJ. NO. P15600.A1

OVERLAY IDENTIFICATION: COMPOSITE, OVERLAY, SCREEN
PROJ NO.
CONTRACT

FILM FORMAT 35 MM

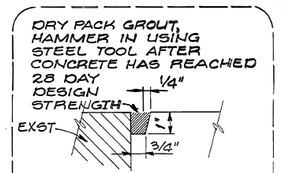


SECTION L
3/8" = 1'-0" 210-M-1

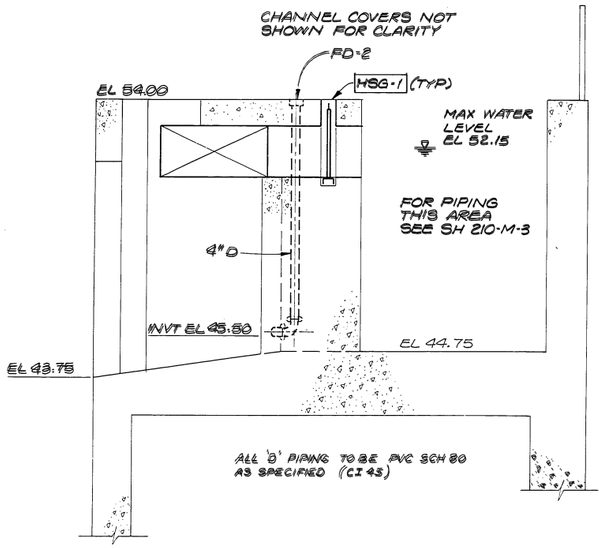


PRIMARY EFFLUENT SAMPLER PLAN

DETAIL 3
3/8" = 1'-0" 210-M-1

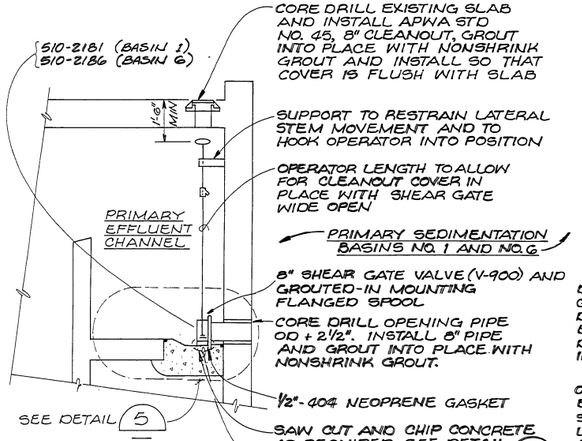


JOINT DETAIL
(4 SIDES)

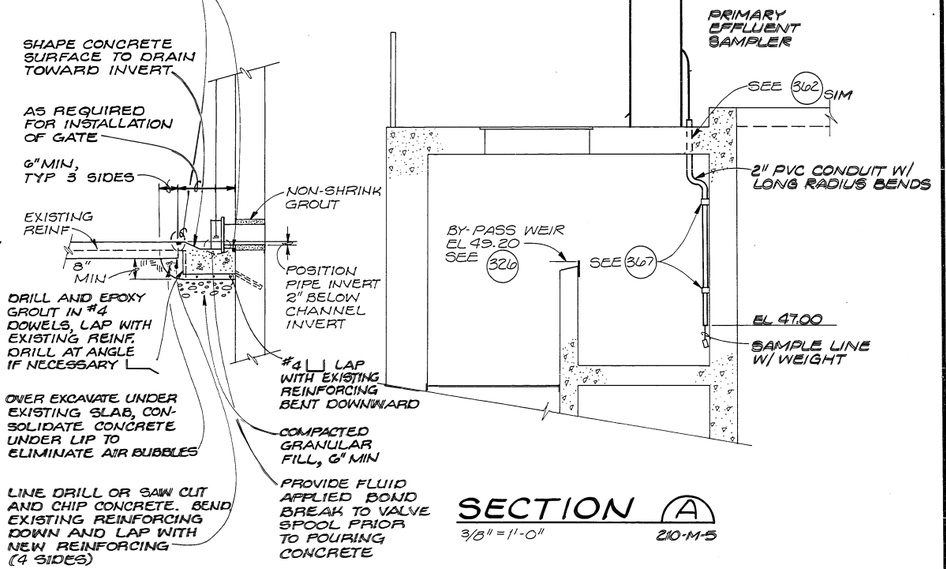


PRIMARY SEDIMENTATION BASIN INLET

SECTION M
3/8" = 1'-0" 210-M-1



DETAIL 4
3/8" = 1'-0" 210-S-2 210-M-1



SECTION A
3/8" = 1'-0" 210-M-5

DETAIL 5
NTS

RECORD DRAWINGS

Revisions Drawn by MJ POPPLETON Date AUG 1993

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REGISTERED PROFESSIONAL ENGINEER 8254 OREGON SEPT. 20, 1974 DONALD C. WRIGHT

CH2M HILL

DSGN	DR	CHK	APVD
Dewright	L.A. MACGILLIVRAY	J.G. FOSS	James W. Foss

NO.	DATE	REVISION	BY	APVD
1	8/26/93 11/90, 10/93/94	RECORD DRAWING MISCELLANEOUS PLANT ADDITIONS CONTRACT 9 RECORD DRAWING	MJP DEJ JPM	RCF RCF JBL

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN
MECHANICAL SECTIONS & DETAILS

SHEET 210-M-5
DWG. NO. 1510-4424
DATE MAY 1983
PROJ NO. P 15680.A1

OVERLAY IDENTIFICATION
COMPOSITE 210-M-5.1
OVERLAY 210-M-5
SCREEN 210-M-5.1
PROJ NO.
CONTRACT

FORMAT 381-223-MC FILM KE 4 SUNS PRINTED 3 83 A2

EFFLUENT CHANNEL TO CHLORINE CONTACT TANK SEE DETAIL PLANS (1) 210-S-6

GENERAL NOTES

GENERAL NOTES

1 LOADS
LOADED WEIGHT PLUS
DEAD WEIGHT LOADS
LIVE LOAD = 100 PSF ELEVATED SLABS AT CHANNEL
= 125 PSF STAIRS
= 75 PSF RIBBED ALUMINUM DECKING
= 25 PSF ROOF
WIND = 80 MPH BASIC WIND
WIND = 80 SHELL BUILDING E.C. SHELL W/ EXPOSURE C
EARTHQUAKE = SEISMIC ZONE 2
EARTHQUAKE = SEISMIC ZONE 2
USC-GS

2 PERFORM LEAKAGE TEST AS SPECIFIED
TEST LEAKAGE TEST AS SPECIFIED
TEST SHOWN ON THE BOTTOM ELEVATION AS SHOWN ON SH 210-S-2

3 VERIFY ALL DIMENSIONS WITH
VERIFY ALL DIMENSIONS WITH EQUIPMENT MANUFACTURER'S. ALL EQUIPMENT MOUNTING HOLES MUST BE
NEGLECTED SHOWN ON EQUIPMENT MANUFACTURER'S DRAWINGS SHALL BE CONTRACTOR'S RESPONSIBILITY

4 BEAM SCHEDULE, SH 210-S-11

5 MATERIAL GRADES (UNLESS OTHERWISE NOTED ON DRAWINGS OR SPECIFICATIONS)

CONCRETE	3000 PSI AT 28 DAYS
REINF STEEL	GR 60
ALUMINUM	T6061-T6
ANCHOR BOLTS	TYPE 304 SST
STRUCT STL	A 36

6 SEE ARCH'L ELEVATIONS AND DETAILS FOR GROOVES AND BEVELS CONST JTS, AS SHOWN IN DWGS SHALL BE ADHERED TO

7 REPETITIVE FEATURES ON SHEETS
REPETITIVE FEATURES ON SHEETS 210-S-1 AND 210-S-2 ARE NOT DRAWN IN THEIR ENTIRETY AND SHALL BE COMPLETED AS PROVIDED AS IF DRAWN IN FULL

8 FOR INTERIOR FINISHES SEE
FOR ROOFING AND INSULATION SEE ARCHITECTURAL SPECIFICATION SECTION 07400

EFFLUENT CHANNEL TO AERATION BASIN SEE SH 210-S-4

REMOVABLE GUARDRAIL REMOVABLE GUARDRAIL W/POST ANCHORAGE TYPE C TYPICAL ALL SIDES ALL OPENING COVERS ALL DECKING COVERS SEE (2) 230 & 233 FOR HANDRAIL MOUNTING

AERATION BASIN
SEE SH 328-S-1
SEE SH 328-S-1

REMOVABLE WALL BELOW
SEE (2) 210-S-6 & (3) 210-S-6

PRIMARY SEDIM 150W SEE SH 210 S-7

GATE OPENING

7'-0" (TYP) 8'-0" (TYP) B 210-S-9 BEAM (TYP)

3-#5 12'-6" TOP & 3-#5x12'-6" LG BOTTOM EA SIDE SEE (2) 210-S-11 (SIM)

WALL BELOW

RIBBED ALUMINUM DECKING COVER SYSTEM TYPE A SEE SH 210-S-12 (TYP) (CI 736)

2-ADDL #5x14'-0" LG (TYP G PLCS)

FEXT-1

SEAL AROUND 40" DIA CONDUIT (GRADE) SIM DET (1) 340-A-1 (CI 493)

OPENING FOR HVAC CONDUIT (TYP OF G) SEE SH 220-H-1 FOR SIZE

GATE GUIDE PIERS BELOW SEE DETAIL PLAN (1) 210-S-4 & (3) 210-S-4

DRIVE OPENING

DRIVE RECESS

VALVE ACCESS HATCH, SEE (243) (TYP OF 3G)

#6@12" x 10'-0" LG SLAB TOP BARS LAP 1'-6" W/ #5@12" AT MIDSPAN (TYP ACROSS BASIN)

VALVE ACCESS HATCH, SEE (243) (TYP OF G)

TYPICAL ALUMINUM CHECKERED PLATE COVER, SEE SH 210-S-13

RIBBED ALUMINUM DECKING COVER SYSTEM TYPE B, SEE SH 210-S-12 (TYP) (CI 736)

HANDRAIL W/ TYPE B ANCHORAGE SYSTEM (CI 464)

LOCATION PER CI 534 (TYP OF G) LOCATED 3" SOUTH (CI 331)

HANDRAIL MOUNTING PER CI 587 & 587a

ALUM OR SST CHECKERED PLATE COVERS PER CI 721 (TYP)

FD RIM EL 53.75 (TYP)

FD RIM EL 53.83

FD RIM EL 53.67 (TYP)

GUTTER DRAIN RIM EL 53.67 (TYP)

RIM EL 53.67 (TYP) 53.83 (TYP)

53.71 (TYP) 53.79 (TYP)

53.92 (TYP)

53.83 (TYP)

53.75 (TYP)

54.00 (TYP)

54.00 (TYP)

53.83 (TYP)

1'-4" (TYP)

12" (CI 464)

10" (TYP)

EQL (TYP)

6'-0" (TYP)

6'-11" (TYP)

7'-3½" (TYP)

1'-0"

2'-0"

4'-0"

6'-3"

6'-4"

B-1 (TYP 12 PLCS)

B-2

B-3

B-4

B-5

B-6

B-7

B-8

B-9

B-10

B-11

210/1C

210/1A

210/1B

DN 54.00

3½" EXP JT

GG'-0"

132'-0 3/4"

54.00 (TYP)

53.92

53.83 (TYP)

53.67 (TYP)

53.71 (TYP)

53.79 (TYP)

53.75 (TYP)

54.00 (TYP)

16'-3" (TYP)

15'-6" (TYP)

13'-9" (TYP)

11'-6" (TYP)

9'-9" (TYP)

7'-6" (TYP)

5'-6"

3'-6"

2'-6"

1'-6"

1'-0"

4'-0"

5'-0"

5'-10"

21'-10"

13'-2"

20'-0"

4'-0" EXT (CI 551)

¾" EXP JT

10'-0"

18'-2"

B-11 (18"x12") SEE DETAIL (2) 210-S-6

181'-0"

1022'-1'-0"

INFLUENT PS PS

SEE SH 110-S-1
SEE SH 110-S-1

LOADING DOCK SEPARATING DOCK SEE SH 210-S-3 (CI 493)

AL GTIF RBOAT MID SPAN

4 SP @ 4'-0"

#4 CONT BARS GRTG W/GS-1 SUPPORTS ALL SIDES (TYP)

2-#5 T & B CONT BARS 2-#5 BENT BARS AT EDGE OF SLAB

NOTCHED ON NORTH SIDE TO INSTALL GATE FRAMES

4 INTERMEDIATE FRAME MEMBERS

4-#6 PLACED ON TOP OF 3-#5 PLACED BEND OF 3-#5 PER BARS (TYP) INTO PIER BELOW (TYP)

VALVE ACCESS HATCH, SEE (243) (TYP OF 2) 18"x12" OPENING, SEE (243) SIM

VALVE ACCESS HATCH, SEE (243) VALVE ACCESS HATCH, SEE (243) (TYP OF 2)

4 INTERMEDIATE FRAME MEMBERS

SCREENINGS BLDG

SEE SH 120-S-1
SEE SH 120-S-1

6-#4 (2'-0" x 3'-0") SEE DETAIL (4) 210-S-8 (SIM)

CHANNEL BELOW SEE PLAN ABOVE EL 51.20; SH 210-S-4

CHANNEL W/ POST ANCHORAGE TYPE A SEE (230) & (233)

CHANNEL IS DISCONTINUOUS CHANNEL IS CONTINUOUS ACROSS ALL EXPANSION JOINTS

GATE OPENINGS GATE GROUND IN AL COVER

INTERMEDIATE FRAME MEMBER LOCATION (TYP) SEE (B) 210-S-13 210-S-13

GRIT CHAMBERS

SEE SH 140-S-1
SEE SH 140-S-1

4 INTERMEDIATE FRAME MEMBERS

* DIMENSIONS TO BE VERIFIED BY GRADE MFR. VERIFIED BY MFR. TYPICAL ALUM OR CHECKERED PLATE COVER

N

PLAN ABOVE EL 54.00

1/8" = 1'-0"

RECORD DRAWINGS

Revisions Drawn by JM LOSTRA Date SEPT 1984

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS

REGISTERED PROFESSIONAL ENGINEER 11,963 OREGON FEB 17, 1983 LOUIS L. ARAGON

CH2M HILL

DSGN	Brad S Metz
DR	D A Fredl
CHK	J P MATHER
APVD	Louis L Aragon

NO	DATE	REVISION	BY	APVD
1	9/16/86	RECORD DRAWINGS	JTL	JEGL

ERASURE NOTICE ON ORIGINAL DRAWING OF [redacted] IF NOT ERASURE NOTICE ON THIS SHEET, ADJUST SCALE ACCORDINGLY

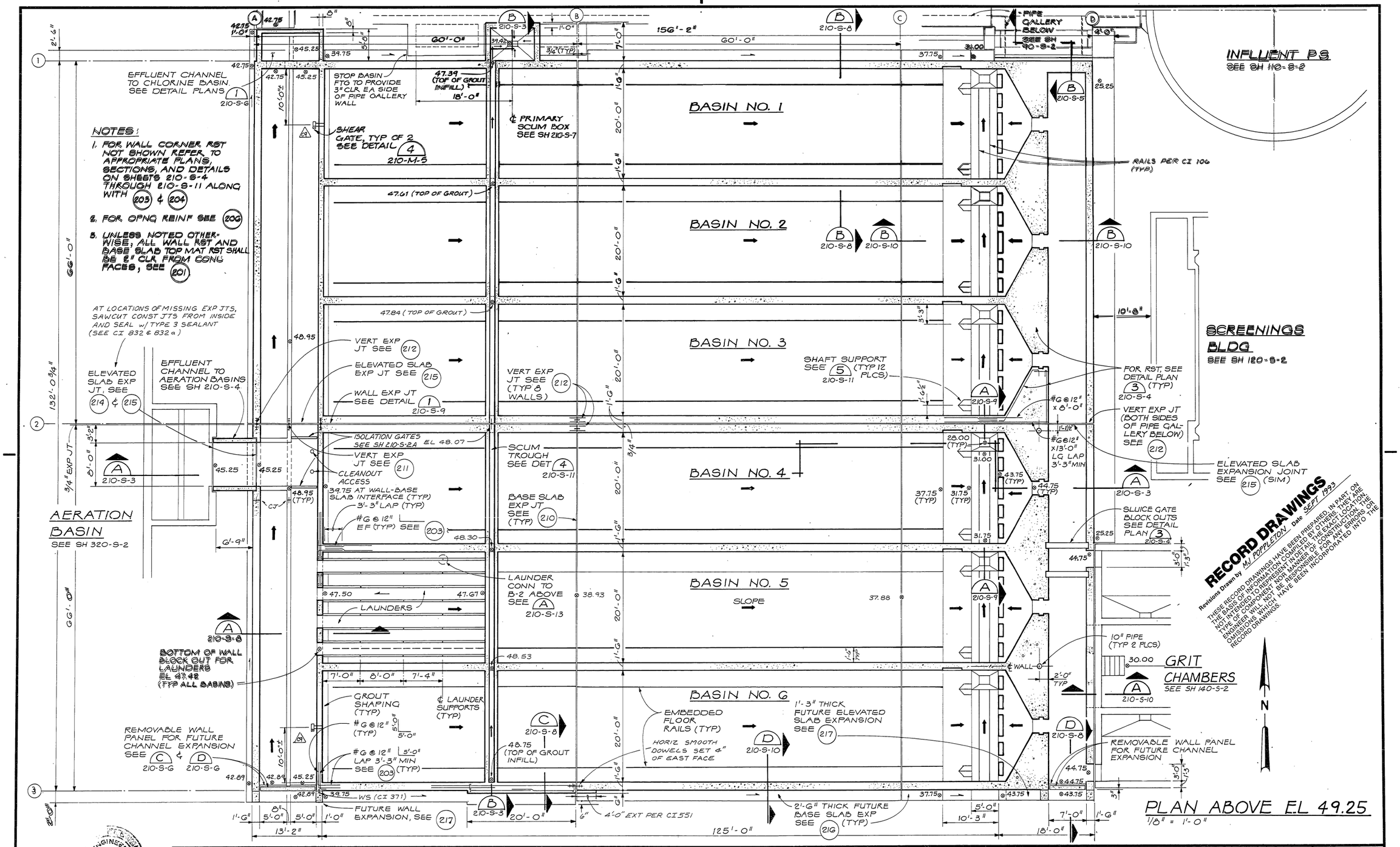
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

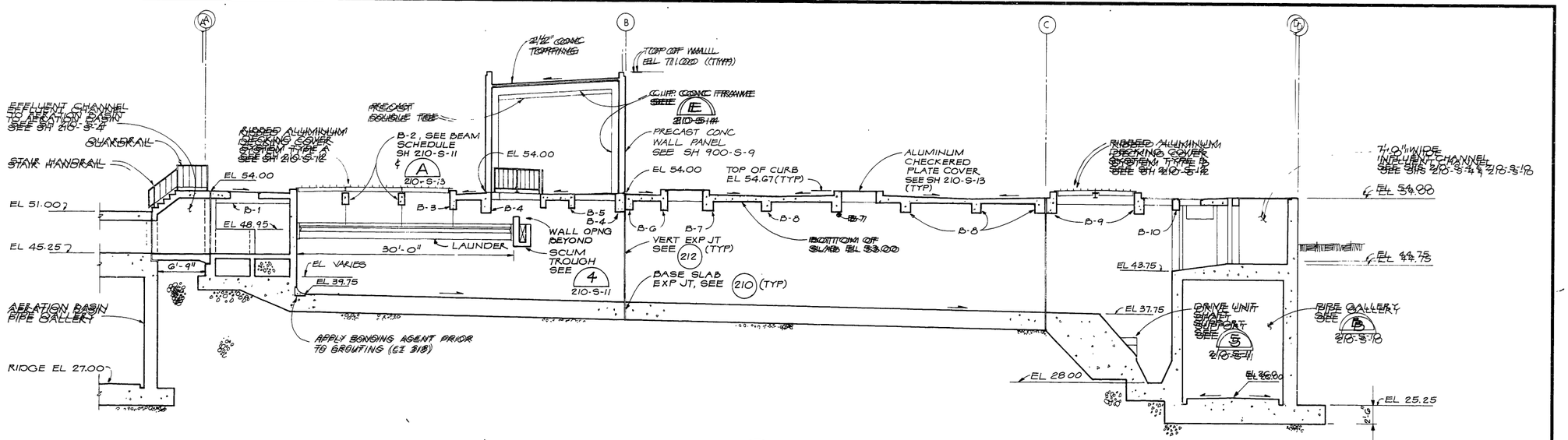
PRIMARY SEDIMENTATION BASIN—PLAN
PRIMARY SEDIMENTATION BASIN—PLAN

SHEET NO	210-S-1
DWG NO	114 OF 176
DATE	MAY 1983
PROJ NO	P-15600.A1

OVERLAY IDENTIFICATION: COMPOSITE, OVERLAY, SCREEN
PROJ NO
CONTRACT

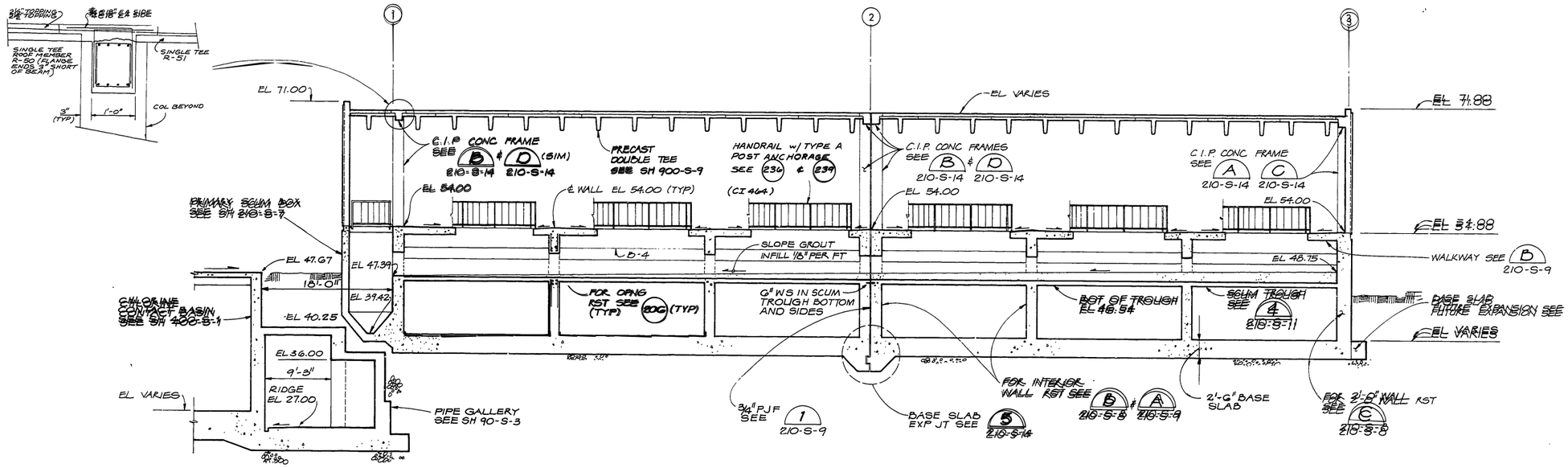
FORMAT 381-2231MC


NOTES:
1. FOR WALL CORNER RST NOT SHOWN REFER TO APPROPRIATE PLANS, SECTIONS, AND DETAILS ON SHEETS 210-S-4 THROUGH 210-S-11 ALONG WITH (203) & (204)
2. FOR OPNG REINF SEE (206)
3. UNLESS NOTED OTHERWISE, ALL WALL RST AND BASE SLAB TOP MAT RST SHALL BE 2" CLR FROM CONC FACES, SEE (201)
EFFLUENT CHANNEL TO CHLORINE BASIN SEE DETAIL PLANS 1 210-S-6
STOP BASIN FTG TO PROVIDE 3" CLR EA SIDE OF PIPE GALLERY WALL
SHEAR GATE, TYP OF 2 SEE DETAIL 4 210-M-5
℄ PRIMARY SCUM BOX SEE SH 210-S-7
47.39 (TOP OF GROUT INFILL)
47.61 (TOP OF GROUT)
47.84 (TOP OF GROUT)
BASIN NO. 1
BASIN NO. 2
BASIN NO. 3
BASIN NO. 4
BASIN NO. 5
BASIN NO. 6
SLOPE
INFLUENT PS
SEE SH 110-S-2
SCREENINGS BLDG
SEE SH 120-S-2
GRIT CHAMBERS
SEE SH 140-S-2
AERATION BASIN
SEE SH 320-S-2
AT LOCATIONS OF MISSING EXP JTS, SAWCUT CONST JTS FROM INSIDE AND SEAL w/ TYPE 3 SEALANT (SEE CI 832 & 832a)
ELEVATED SLAB EXP JT, SEE (214) & (215)
EFFLUENT CHANNEL TO AERATION BASINS SEE SH 210-S-4
VERT EXP JT SEE (212)
ELEVATED SLAB EXP JT SEE (215)
WALL EXP JT SEE DETAIL 1 210-S-9
ISOLATION GATES SEE SH 210-S-2A EL 48.07
VERT EXP JT SEE (211)
CLEANOUT ACCESS
39.75 AT WALL-BASE SLAB INTERFACE (TYP)
3'-3" LAP (TYP)
#G @ 12" EF (TYP) SEE (203)
BASE SLAB EXP JT SEE (210)
SCUM TROUGH SEE DET 4 210-S-11
LAUNDER CONN TO B-2 ABOVE SEE A 210-S-13
LAUNDERS
BOTTOM OF WALL BLOCK OUT FOR LAUNDERS EL 47.42 (TYP ALL BASINS)
GROUT SHAPING (TYP)
℄ LAUNDER SUPPORTS (TYP)
REMOVABLE WALL PANEL FOR FUTURE CHANNEL EXPANSION SEE C 210-S-6 & D 210-S-6
FUTURE WALL EXPANSION, SEE (217)
VERT EXP JT SEE (212) (TYP 8 WALLS)
SHAFT SUPPORT SEE 5 210-S-11 (TYP 12 PLCS)
EMBEDDED FLOOR RAILS (TYP)
HORIZ SMOOTH DOWELS SET 4" OF EAST FACE
1'-3" THICK FUTURE ELEVATED SLAB EXPANSION SEE (217)
2'-0" THICK FUTURE BASE SLAB EXP SEE (216) (TYP)
4'-0" EXT PER CI 551
PIPE GALLERY BELOW SEE SH 110-S-2
RAILS PER CI 106 (TYP)
FOR RST, SEE DETAIL PLAN 3 210-S-4 (TYP)
VERT EXP JT (BOTH SIDES OF PIPE GALLERY BELOW) SEE (212)
#G@12" x 8'-0"
#G@12" x13'-0" LG LAP 3'-3" MIN
ELEVATED SLAB EXPANSION JOINT SEE (215) (SIM)
SLUICE GATE BLOCK OUTS SEE DETAIL PLAN 3 210-S-4
10" PIPE (TYP 2 PLCS)
℄ WALL
REMOVABLE WALL PANEL FOR FUTURE CHANNEL EXPANSION
RECORD DRAWINGS
Revisions Drawn by MJ POPPLETON Date SEPT 1993
THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL OR EXACT LOCATION THE EXACT CONSTRUCTION OF THE COMPONENT NOR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.
PLAN ABOVE EL 49.25
1/8" = 1'-0"
CH2M HILL
DSGN Grant L Stein
DR Da Frisch
CHK J.P. MATHER
APVD
NO. 3 DATE 9/13/93 RECORD DRAWING
NO. 2 DATE 6/90 MISCELLANEOUS PLANT ADDITIONS CONTRACT C9 RECORD DRAWING
NO. 1 DATE 9/26/86 REVISION
BY MJP MJM JML
APVD RCF RCF JBL
PROFESSIONAL ENGINEER LUIS L ARAGON OREGON 11,968 EXPIRES: 12-31-93
VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT
PRIMARY SEDIMENTATION BASIN—FOUNDATION PLAN
SHEET 210-S-2
DWG. NO. 120 OF 496
DATE MAY 1993
PROJ NO P 15660.A1



SECTION A
1/8" = 1'-0" 210-S-1 210-S-2

(CI 385)



SECTION B
1/8" = 1'-0" 210-S-1 210-S-2

RECORD DRAWINGS

Revisions Drawn by JIM LOSTRA Date SEPT 1986

THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION FURNISHED BY OTHERS. THEY ARE NOT INTENDED TO REPRESENT IN DETAIL THE EXACT LOCATION, TYPE OF CONSTRUCTION, OR MANNER OF CONSTRUCTION. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY ERRORS OR OMISSIONS WHICH HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

REGISTERED PROFESSIONAL ENGINEER — OREGON — 11,926 — LUIS L. ARAGON — EXPIRES: FEB. 17, 1985

CH2M HILL

DSGN	Brad L. Stein			
DR	Da Frial			
CHK	J.P. MATHER			
APVD				
NO.	DATE	REVISION	BY	APVD
	9/26/86	RECORD DRAWINGS	JTML	JTBL

VERIFY SCALES
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

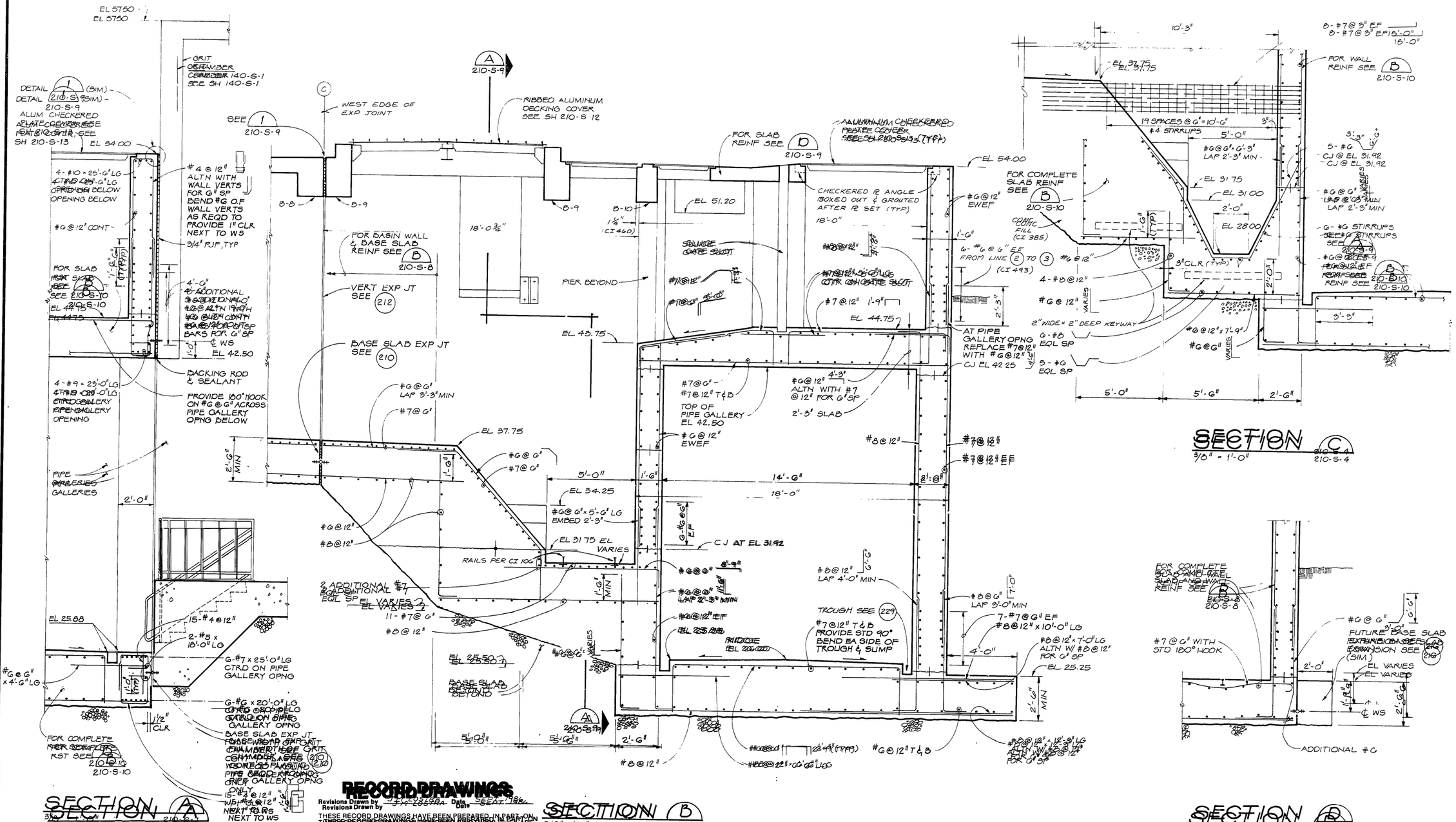
TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN — SECTIONS
PRIMARY SEDIMENTATION BASIN — SECTIONS

SHEET 210-S-3
DWG NO. 210-S-3
DRWG NO. 121 OF 240
DATE MAY 1983
PROJ NO. P 15600.A1

OVERLAY IDENTIFICATION
PROJ. NO.
CONTRACT
COMPOSITE
OVERLAY
SCREEN

FORMAT 381 237 MC
SUNIT PRINTED
FILM KE



RECORD DRAWINGS
THESE RECORD DRAWINGS HAVE BEEN PREPARED, IN PART, ON THE BASIS OF INFORMATION FURNISHED BY OTHERS. THEY ARE NOT BASED ON FIELD OBSERVATION BY THE ENGINEER OF THE CONSTRUCTION. THE ENGINEER DOES NOT ASSUME RESPONSIBILITY FOR THE CONSTRUCTION OR OPERATION OF THE FACILITIES OR FOR THE ACCURACY OF THE INFORMATION WHICH MAY HAVE BEEN INCORPORATED INTO THE RECORD DRAWINGS.

Revisions Drawn by JJH Date SEPT 1984
Revisions Drawn by Date

REGISTERED PROFESSIONAL ENGINEER 11968 Luis L. Aragon EXPIRES: JUNE 17, 1985

CH2M HILL

DSGN	Brad L. Stein
DR	Dan Fried
CHK	J.P. MATHER
APVD	

NO.	DATE	REVISION	BY	APVD
1	9/21/84	RECORD DRAWING	JJH	

VERIFY SCALES
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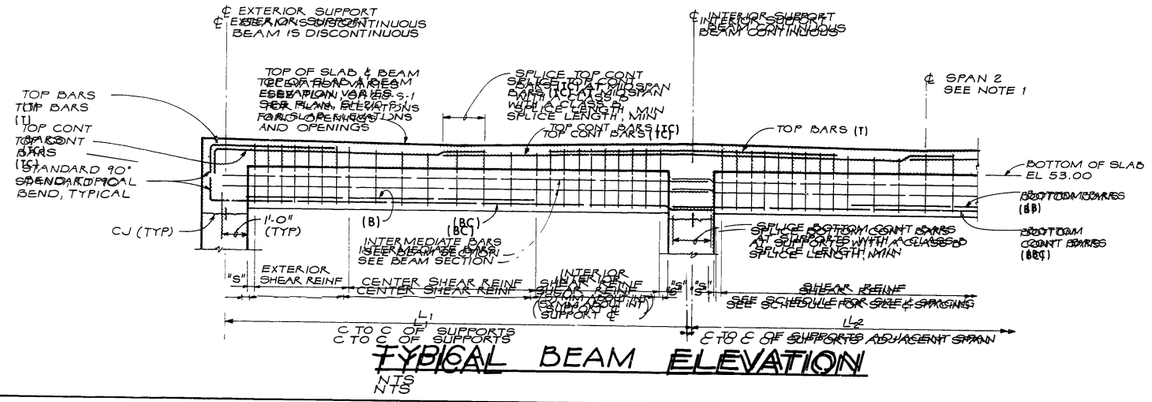
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN—SECTIONS
PRIMARY SEDIMENTATION BASIN—SECTIONS

SHEET 210-S-10
SHEET 210-S-10
DWG. 128 OF 474
DATE MAY 1983
FILE P 15600.A1
PROJ NO. P 15600.A1



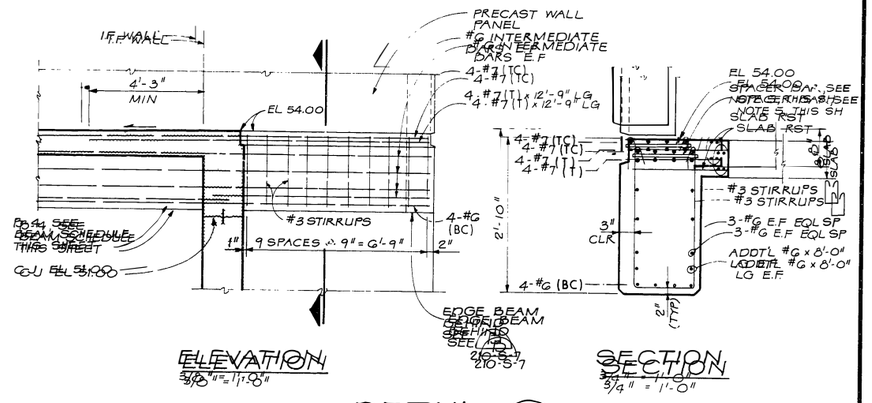
TYPICAL BEAM ELEVATION

NTS

BEAM SCHEDULE

BEAM MARK (SEE PLANS)	SIZE W	SIZE BOTTOM OF BEAM ELEVATION	TOP REINF AT EXTERIOR SUPPORT T	TOP REINF AT EXTERIOR SUPPORT TC	BOTTOM REINF B	BOTTOM REINF BC	TOP REINF AT INTERIOR SUPPORT T	TOP REINF AT INTERIOR SUPPORT TC	EXTERIOR SHEAR REINF NO. & SIZE	EXTERIOR SHEAR REINF SPACING & "S"	CENTER SHEAR REINF NO. & SIZE	CENTER SHEAR REINF SPACING & "S"	INTERIOR SHEAR REINF NO. & SIZE	INTERIOR SHEAR REINF SPACING & "S"	COMMENTS
B-1	12"	52.17	–	3-#6	–	2-#6	–	–	–	–	11-#3	12@ 5@2", 6@4", REST @ 12"	–	–	SEE NOTE 1
B-1	12"	52.17	–	3-#6	–	4-#6	–	–	–	–					
B-2	12"	52.25	–	4-#7	–	4-#6	–	–	–	–	28-#3	12@ 5@2", 6@4", REST @ 12"	–	–	SEE SECTION A 210-S-13
B-2	12"	52.25	–	4-#7	–	4-#6	–	–	–	–					
B-3	12"	51.67	–	3-#6	–	4-#6	–	–	–	–	28-#3	12@ 5@2", 6@4", REST @ 12"	–	–	
B-3	12"	51.67	–	3-#6	–	4-#6	–	–	–	–					
B-4	18"	51.17	4-#7 L = 44'-4"(a) L = 4'-3"(a)	4-#7 4-#7	4-#7 L = 46'-4"(a) L = 16'-9"(a)	4-#6 4-#6	4-#7 L = 9'-11"(B) L = 11'-2"(B)	4-#7	6-#3	6@ 3@3", REST @ 12"	9-#3	12@ 3", REST @ 12"	15-#3	6@ 3", REST @ 12"	SEE NOTES 3, G, & 7 AND DETAIL 1 210-S-11
B-4	18"	51.17													
B-5	10"	51.67	–	3-#6	–	3-#6	–	–	–	–	28-#3	12@ 5@2", REST @ 6"	–	–	
B-5	10"	51.67	–	3-#6	–	3-#6	–	–	–	–					
B-6	12"	51.67	2-#6 L = 23'-8"(a) L = 3'-6"(a)	2-#6 2-#6	–	3-#6 3-#6	2-#6 L = 2'-0"(B) L = 4'-0"(B)	2-#6	–	–	28-#3	12@ 5@2", REST @ 6"	–	–	SEE NOTE 3
B-6	12"	51.67	4-#6												
B-7	10"	51.67	L = 44'-8"(a) L = 4'-6"(a)	2-#6 2-#6	–	4-#6 4-#6	2-#6 L = 10'-5"(B) L = 10'-5"(B)	2-#6	–	–	28-#3	12@ 5@2", REST @ 6"	–	–	SEE NOTE 3
B-7	10"	51.67													
B-8	18"	51.67	2-#7 L = 28'-8"(a) L = 2'-6"(a)	4-#6 4-#6	2-#6 L = 28'-8"(a) L = 12'-0"(a)	4-#6 4-#6	2-#6 L = 2'-0"(B) L = 9'-0"(B)	4-#6	–	–	28-#3	12@ 5@2", REST @ 6"	–	–	SEE NOTE 3
B-8	18"	51.67													
B-9	18"	51.67	2-#6 L = 23'-8"(a) L = 3'-0"(a)	2-#6 2-#6	2-#6 L = 28'-8"(a) L = 12'-0"(a)	2-#6 2-#6	2-#6 L = 2'-0"(B) L = 3'-0"(B)	2-#6	–	–	28-#3	12@ 5@2", REST @ 6"	–	–	SEE NOTE 3
B-9	18"	51.67													
B-10	13½"	51.67	–	3-#6	–	3-#6	–	–	–	–	28-#3	12@ 5@2", REST @ 6"	–	–	SEE NOTES 8 & 9
B-10	13½"	51.67	–	3-#6	–	3-#6	–	–	–	–					
* B-11	18"	53.00	–	4-#6	–	4-#6	–	–	–	–	#VARIES #3	6" S VARIES	–	–	SEE DETAIL 2 210-S-6
* B-11	18"	53.00	–	4-#6	–	4-#5	–	–	–	–					

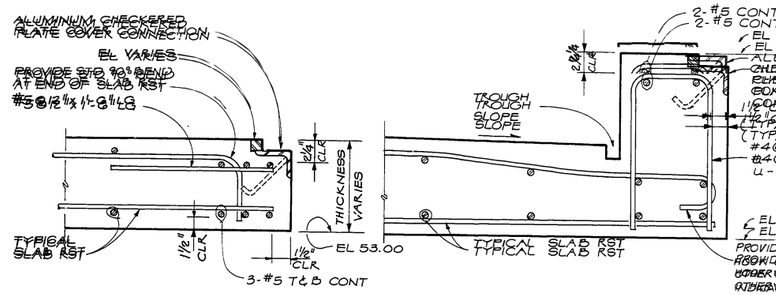
* 53 25 FOR BEAMS @ BLDG LINE (5) - INF CHANNEL SPAN (CI 3564)
* 53 25 FOR BEAMS @ BLDG LINE (2) - INF CHANNEL SPAN (CI 3564)



ELEVATION 3/16" = 1'-0"

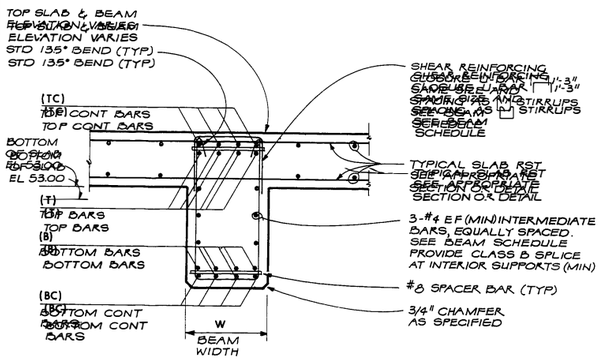
SECTION 3/4" = 1'-0"

DETAIL 1 AS SHOWN — 210-S-7, 210-S-11



DETAIL 2 1½" = 1'-0" — 210-S-8, 210-S-9

DETAIL 3 1½" = 1'-0" — 210-S-9

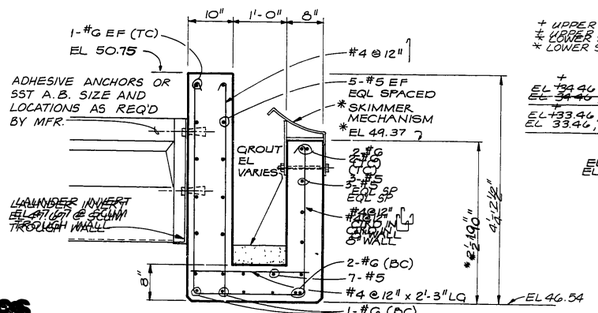


TYPICAL BEAM SECTION

NTS

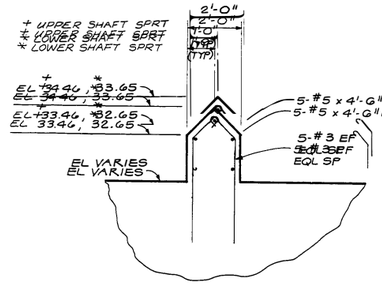
BEAM NOTES

1. ALL BEAMS, WITH THE EXCEPTION OF B-1, & B-11 ARE THREE SPAN CONTINUOUS WITH ALL SPANS BEING EQUAL (L1=L2=L3).
2. THE EXTERIOR END OF A BEAM SHALL BE CONSIDERED TO BE AT ALL SUPPORTS WHERE THE BEAM IS DISCONTINUOUS.
3. BAR LENGTHS (WHEN GIVEN) ARE REFERENCED TO:
   A. FACE OF EXTERIOR SUPPORT
   B. FULL LENGTH GIVEN, SYMMETRICAL ABOUT INTERIOR SUPPORT CENTERLINE
4. TOP BARS SHALL ADHERE TO THE SLOPED SURFACES AS SHOWN IN PLAN. SH 210-S-11
5. CLEAR SPACING BETWEEN BARS IN ONE LAYER SHALL BE 2" MINIMUM CLEAR SPACING BETWEEN LAYERS SHALL BE 1" AND MAINTAINED WITH A #8 SPACER BAR @ 2'-0" OC
6. THERE SHALL BE ONE CONTINUOUS BAR AT EACH CORNER OF ALL STIRRUPS. UNLESS NOTED OTHERWISE ALL REINFORCING STEEL SHALL BE 1½" CLEAR FROM CONCRETE FACES. REINFORCING STEEL SHALL BE DEPRESSED AT TROUGHS AS REQUIRED, TO PROVIDE MINIMUM CLEARANCES.
7. ADD 3-#6 EACH FACE EQUALLY SPACED BELOW BOTTOM OF SLAB.
8. ADD 3-#6 EACH FACE EQUALLY SPACED BELOW BOTTOM OF SLAB.
9. INCLUDE SHEAR REINFORCING CLOSURE U-BAR SHOWN IN TYPICAL BEAM SECTION.
10. FOR ADDITIONAL STRUCTURAL NOTES SEE (2C01)



DETAIL 4 3/4" = 1'-0" — 210-S-2, 210-S-3, 210-S-7

* ELEVATIONS, DIMENSIONS & EQUIPMENT TO BE VERIFIED & SUPPLIED BY SKIMMER MFR



SHAFT SUPPORT DETAIL 3/8" = 1'-0" — 210-S-12, 210-S-23, 210-S-3

RECORD DRAWINGS
Revision Drawn by JIM LOBSTRA Date SEPT 1988
THESE RECORD DRAWINGS HAVE BEEN PREPARED IN PART ON THE BASIS OF INFORMATION COMPILED BY OTHERS. THEY ARE NOT INTENDED TO BE A PRECISE AS-BUILT RECORD OF THE EXACT LOCATION, TYPE OR DIMENSIONS OF THE FACILITIES AS CONSTRUCTED. THE ENGINEER WILL NOT BE RESPONSIBLE FOR ANY DECISIONS BASED ON THESE RECORD DRAWINGS SUBSEQUENT TO THE PREPARATION OF THE RECORD DRAWINGS.

TYPICAL BEAM SECTION

REGISTERED PROFESSIONAL ENGINEER — LUIS L. ARAGON — OREGON — FEB. 17, 1978

CH2M HILL

DSGN	Brad L. Stein
DR	Ora Friel
CHK	J.P. MATHER
APVD	

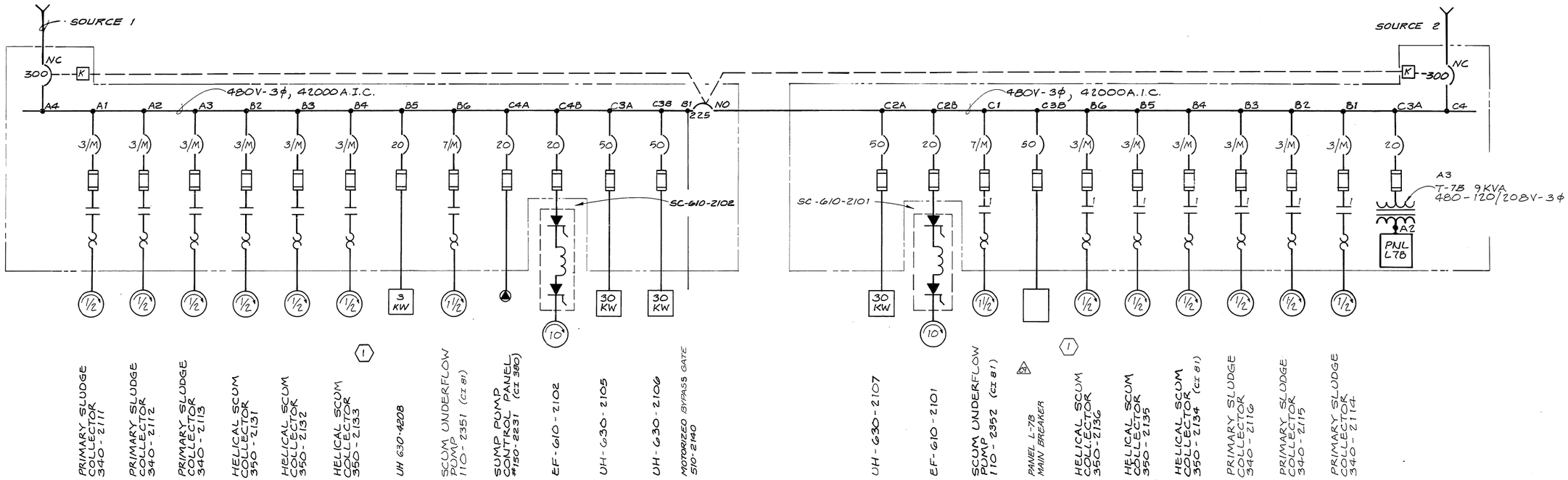
NO.	DATE	REVISION	BY	APVD
1	9/16/88	RECORD DRAWING	JTM	JPM

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"
IF NOT ONE INCH ON THIS SHEET ADJUST SCALES ACCORDINGLY

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PRIMARY SEDIMENTATION BASIN—BEAMS AND DETAILS
PRIMARY SEDIMENTATION BASIN—BEAMS AND DETAILS

SHEET 210-S-11
SHEET G, 129 OF 436
DRG. NO. 129 OF 436
DATE MAY 1983
DATE
PROJ NO. P 13600.A1



MCC 7A ONE LINE DIAGRAM
N.T.S.

MCC 7B ONE LINE DIAGRAM
N.T.S.

SC-610-2101	SC-610-2102

SPEED CONTROLLERS ELEV
NTS

A	B	C	A	B	C
1	1		1	1	(SPACE)
2	2	1		2	2A 2B
3	3		2	3	3A 3B
	4	2		4	
	5	3A 3B		5	
4	6	4A 4B	3	6	4

1

MCC 7A & 7B ELEVATION

RECORD DRAWINGS
Revisions Drawn by MJ POPPLETON Date NOV 1993

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REGISTERED PROFESSIONAL ENGINEER 8051 OREGON JULY 12, 1968 WILLIAM F. TOOLE

CH2M HILL

DSGN T.B. Joyce
DR T.J. Hayes
CHK W.F. TOOLE
APVD

NO.	DATE	REVISION	BY	APVD
2	11/2/83 6/90 10/17/84	RECORD DRAWING MISCELLANEOUS PLANT ADDITIONS CONTRACT 09 RECORD DRAWING	MJP JGS JML	RCF RCF JBL
1	7/1/83	ADDENDUM NO. 3	VAP	JGS

VERIFY SCALES
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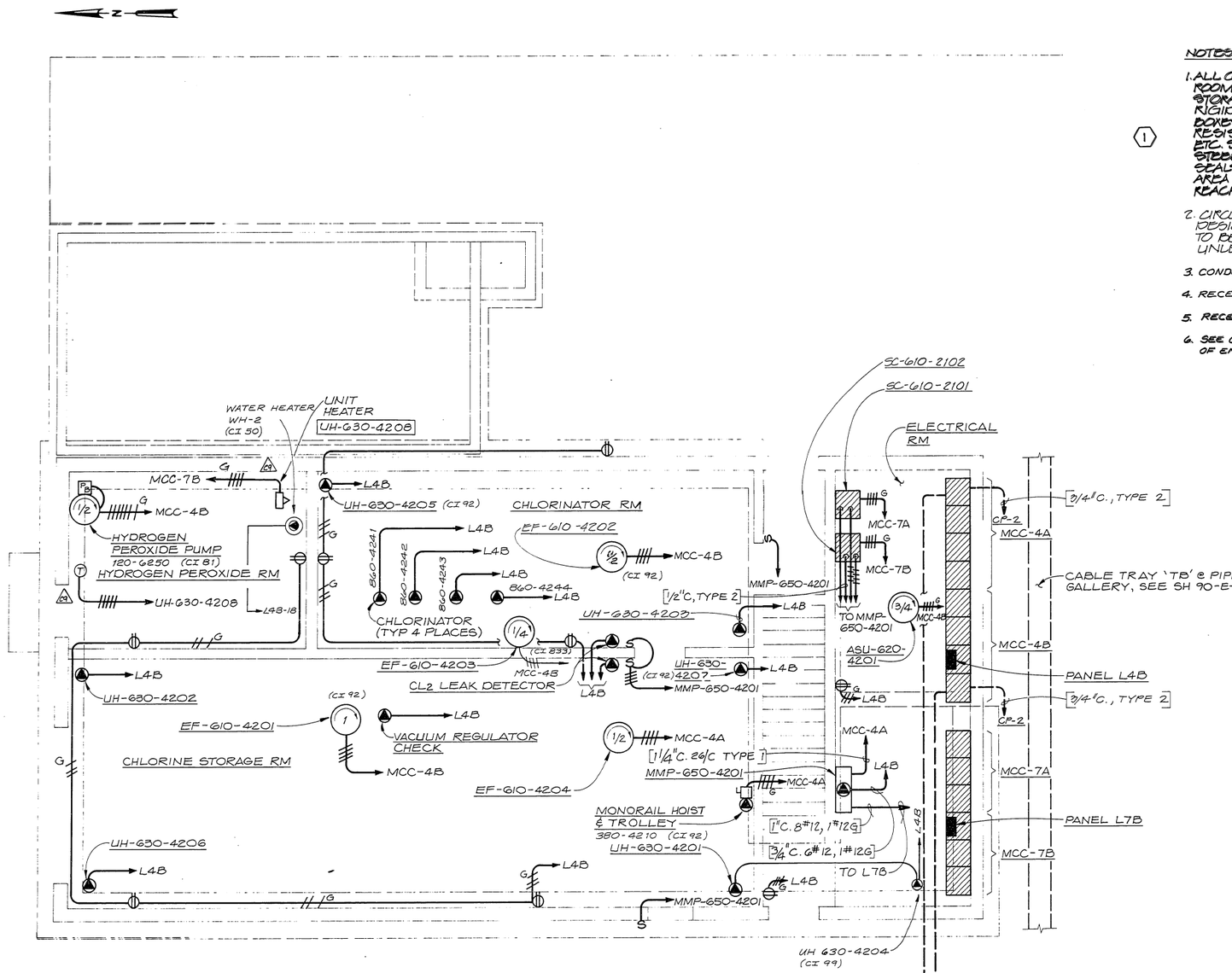
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

MCC 7A, 7B ONE LINE DIAGRAM AND ELEVATIONS

SHEET 420-E-2
DWG. NO. 289 OF 496
DATE MAY 1983
PROJ NO. P 15600.A1

OVERLAY IDENTIFICATION
PROJ NO.
CONTRACT
COMPOSITE 420-E-2
OVERLAY 420-E-2
SCREEN 420E-2.1



POWER PLAN

1/4" = 1'-0"

NOTES:

1. ALL CONDUIT IN THE HYDROGEN PEROXIDE ROOM, CHLORINATOR ROOM, AND CHLORINE STORAGE ROOM SHALL BE PVC-COATED RIGID GALVANIZED STEEL. ALL JUNCTION BOXES SHALL BE FIBERGLASS, CORROSION-RESISTANT. ALL CONDUIT FITTINGS, HANGERS ETC. SHALL BE PVC-COATED RIGID GALVANIZED STEEL. CONTRACTOR SHALL INSTALL CONDUIT SEALS IN CONDUIT BEFORE CONDUIT LEAVES AREA TO PROHIBIT CHLORINE GAS FROM REACHING OTHER AREAS. (1)
2. CIRCUITS FROM MCC'S WHICH ARE DESIGNATED TYPE 1 OR TYPE 6 ARE TO BE ROUTED VIA CABLE TRAY 'TB' UNLESS INDICATED OTHERWISE.
3. CONDUIT TO BE EXPOSED, UNDER SLAB, OR EMBEDDED
4. RECEPTACLES TO BE PVC COATED W/ PLASTIC COVERS
5. RECEPTACLES TO BE MOUNTED 4' AFF
6. SEE CONSTRUCTION PHOTOS FOR APPROX LOCATION OF EMBEDDED CONDUITS.

RECORD DRAWINGS

Revisions Drawn by MJ POPPLETON Date OCT 1993

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REGISTERED PROFESSIONAL ENGINEER OREGON JULY 12, 1983 WILLIAM F. TOOLE
SOS! William F. Toole

CH2M HILL

DSGN T.B. Joyce		12/13/93	RECORD DRAWING	MJP	RCF
DR E.P. DUARTE	2	6/1/93	MISCELLANEOUS PLANT ADDITIONS CONTRACT C9 RECORD DRAWING	JRK	JBL
CHK W.F. TOOLE	1	7/1/83	ADDENDUM NO.3	VAP	JCG
APVD	NO.	DATE	REVISION	BY	APVD

VERIFY SCALES
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TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

CHLORINE BUILDING POWER PLAN

SHEET 420-E-4
DWG. NO. 241 OF 436
DATE MAY 1983
PROJ NO. P 15600.A1

OVERLAY IDENTIFICATION | COMPOSITE 420-E-4 | OVERLAY 420-E-4 | SCREEN
PROJ NO. | 420-E-4.1 | 420-E-4.1
CONTRACT

FILM KE FORMAT 381-2324NG 4 SHT PRINTED 3 B3 A2

PANEL L1A SEE PR 71 LOCATION INFLUENT P.S.
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC-1A MAINS BRKR SIZE 50A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
INFLUENT P.S. MOTOR FLR LTG	20/1	1	2	20/1	SPARE
INFLUENT P.S. INTER. FLR LTG	20/1	3	4	20/1	INFLUENT P.S. PUMP FLR LTG
INFLUENT P.S. BLDG EXT. LTG	20/1	5	6	20/1	INFLUENT P.S. MOTOR FLR RECPT
INFLUENT P.S. MOTOR FLR RECPT	20/1	7	8	20/1	INFLUENT P.S. INTER FLR RECPT
INFLUENT P.S. PUMP FLR LTG	20/1	9	10	20/1	PIPE GALLERY RECPT
EP-1	20/1	11	12	20/1	MMP-650-1101
UH-630-1101	20/2	13	14	20/1	UH-630-1102
SPACE		15	16		SPACE
LP-D1	20/1	17	18	20/1	LP-D2
LP-D3	20/1	19	20	20/1	LP-D4
LP-D5	20/1	21	22	20/1	LP-D6
AIT-4183	20/1	23	24	20/1	PLE SAMPLE PUMP
ROADWAY LTG	20/1	25	26	20/1	DIT 2220
SPARE	20/1	27	28	20/1	AUTOMATIC DOOR OPR
		29	30		

(1)

PANEL L2A SEE PR 71 LOCATION INFLUENT P.S.
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC-2A MAINS BRKR SIZE 50A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
SCREEN BLDG UPPER LEVEL LTG	20/1	1	2	20/1	SCREEN BLDG UPPER LEVEL LTG
SCREEN BLDG UPPER LEVEL LTG	20/1	3	4	20/1	SCREEN BLDG UPPER LEVEL LTG
SCREEN BLDG LOWER LEVEL LTG	20/1	5	6	20/1	SCREEN BLDG LOW LEVEL LTG
SCREEN BLDG EXT. LTG	20/1	7	8	20/1	SPARE
SCREEN BLDG UPPER LEVEL RECPT	20/1	9	10	20/1	SCREEN BLDG UPPER LEVEL RECPT
SCREEN BLDG LOW LEVEL RECPT	20/1	11	12	20/1	SCREEN BLDG LOW LEVEL RECPT
DOOR OPR #1	20/2	13	14	20/2	DOOR OPR #2
		15	16		
EF-610-1203 VIA MMP650#1101	20/1	17	18	40/2	HIGH PRESSURE WASHER RECPT (PR 43)
SPARE	20/1	19	20		
SCREEN BLDG STOR. RM LTG	20/1	21	22	20/1	SPARE
SPARE	20/1	23	24	20/1	SPARE

PANEL L3A LOCATION INFLUENT P.S.
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC-3A MAINS BRKR SIZE 50A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
GRIT BLDG LOW LEVEL LTG	20/1	1	2	20/1	GRIT BLDG LOW LEVEL LTG
GRIT BLDG LOW LEVEL LTG	20/1	3	4	20/1	GRIT BLDG UPPER LEVEL LTG
GRIT BLDG STAIRWELL LTG	20/1	5	6	20/1	SPARE
GRIT BLDG LOW LEVEL RECPT	20/1	7	8	20/1	GRIT BLDG UPPER LEVEL RECPT
GRIT BLDG STAIRWELL RECPT	20/1	9	10	20/1	SPARE
LP-C1	20/1	11	12	20/1	EP-610-1403
SPACE		13	14		SPACE
		15	16		

PANEL L4B LOCATION CL_2 BLDG
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC-4B MAINS BRKR SIZE 50A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
CL_2 BLDG ELEC RM LTG	20/1	1	2	20/1	CL_2 BLDG STAIRWELL LTG
CL_2 BLDG CHLORINATOR RM LTG	20/1	3	4	20/1	CL_2 BLDG EXTERIOR LTG
PIPE GALLERY LTG	20/1	5	6	20/1	PIPE GALLERY LTG
NONPOTABLE WATER P.S. LTG	20/1	7	8	20/1	CONTACT BASIN LTG
CL_2 BLDG CHLORINATOR RM RECPT	20/1	9	10	20/1	CL_2 BLDG ELEC RM LTG
CL_2 BLDG STORAGE RM RECPT	20/1	11	12	20/1	PIPE GALLERY RECPT
PIPE GALLERY RECPT	20/1	13	14	20/1	CONTACT BASIN RECPT
SPARE (EE 59)	20/1	15	16	20/1	EF 610-4203
CONTACT BASIN RECPT	20/1	17	18	20/1	WH-2
NONPOTABLE WATER P.S. RECPT	20/1	19	20	20/1	CHLORINATOR #2
CHLORINATOR #1	20/1	21	22	20/1	CHLORINATOR #4
CHLORINATOR #3	20/1	23	24	50/1	MMP-650-4201
CL_2 HEADER HEATERS	20/1	25	26	20/1	UH-630-4203
UH-630-4202	20/1	27	28	20/1	UH-630-4205
UH-630-4207	20/1	29	30	20/1	SPARE
UH-630-4206	20/1	31	32	20/1	SAMPLER 350-4140
SAMPLER 350-4150	20/1	33	34	20/1	PIPE GALLERY RECPT
CL_2 STORAGE LTG	20/1	35	36	20/1	CL_2 LEAK DETECT
CL_2 LEAK DETECT	20/1	37	38	20/1	UH-630-4201
SF 620-3302 VIA MMP 650-4201	20/1	39	40	20/1	SPARE
SPARE	20/1	41	42	20/1	SPARE

PANEL L5 LOCATION BLOWER BLDG
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC-5E MAINS BRKR SIZE 50A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
BLOWER RM LTG	20/1	1	2	20/1	RECEPTACLES
BLOWER RM LTG	20/1	3	4	20/1	RECEPTACLES
SPARE	20/1	5	6	20/1	RECEPTACLES
UPPER LEVEL LTG	20/2	7	8	20/1	RECEPTACLES
		9	10	20/1	REGENERATIVE DRYER 370-2431
CONTROL ROOM LTG	20/1	11	12	20/1	REGENERATIVE DRYER 370-2432
EMERG LTG	20/1	13	14	20/1	WH-2 1KW
BUILDING EXTERIOR LTG	20/1	15	16	20/1	COMMUNICATIONS SYSTEM
NIGHT LIGHT	20/1	17	18	20/1	SWBD 2A, SHUTDOWN RELAY
CONTROL PANEL CP-2	20/1	19	20	20/1	SPARE
MMP PANEL 650-1101	20/1	21	22	20/1	SPARE
SPARE	20/1	23	24	20/1	SPARE
ROADWAY LTG	20/1	25	26	20/1	SPARE
SPARE	20/1	27	28	20/1	SPARE
SPACE		29	30		SPACE
		31	32		
		33	34		
		35	36		
		37	38		
		39	40		
		41	42		

(2)

PANEL L14 LOCATION SLUDGE LOADING AREA
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING WALL MAINS BRKR SIZE 60A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
LIGHTS	20/1	1	2	20/1	CONTROL STATION (FI/FSI-5490)
WEST RECPT/EXTENSION CORD	20/1	3	4	20/1	FIT-5490 (IN GALLERY)
EAST RECPT/EXTENSION CORD	20/1	5	6	20/1	SPARE
SPARE	20/1	7	8	20/1	SPARE
RADIANT HEATER	20/2	9	10	20/1	SPARE
		11	12	20/1	SPARE

PANEL L6 LOCATION RAS PUMP STATION
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC 6E MAINS BRKR SIZE 100A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
UPPER LEVEL LTG	20/1	1	2	20/1	UPPER LEVEL RECPT
LOWER LEVEL LTG	20/1	3	4	20/1	LOWER LEVEL RECPT
GALLERY EXIT SIGN	20/1	5	6	20/1	SPARE
SECONDARY CLAR. LTG & RECPT	20/1	7	8	20/1	UH-630-3401, 3402
BUILDING EXTERIOR LTG	20/1	9	10	20/1	UH-630-3403, 3404
EMERG LTG	20/1	11	12	20/1	SPARE
COMMUNICATIONS SYSTEM	20/1	13	14	20/1	GALLERY LTG
FT 3421	20/1	15	16	20/1	GALLERY LTG
FT 3422	20/1	17	18	20/1	GALLERY LTG
AIT 3201, 3261	20/1	19	20	20/1	GALLERY RECPT
AIT 3202, 3262	20/1	21	22	20/1	SPARE
AIT 3203, 3263	20/1	23	24	20/1	FIT 3491, 3492
AIT 3204, 3264	20/1	25	26	20/1	FIT 3493, 3494
38M PIPE 340-3311 (EE 54)	20/1	27	28	20/1	SF 620-3201 VIA MMP 630-3401
38M PIPE 340-3312 (EE 54)	20/1	29	30	20/1	SF 620-3202 VIA MMP 630-3401
SPARE	20/1	31	32	20/1	AERATION BASIN LTG
SPARE	20/1	33	34	20/1	AERATION BASIN LTG
WH-1, 1KW	20/1	35	36	20/1	AERATION BASIN RECPT
CONTROL PANEL CP-3	20/1	37	38	20/1	ROWY LTG
CONTROL PANEL CP-3	20/1	39	40	20/1	SPARE
MMP PANEL 650-3401	40/1	41	42	20/1	SPARE

(EE 76? & 81A)

PANEL L7B LOCATION CL_2 BLDG
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC-7B MAINS BRKR SIZE 50A

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
SED BLDG LTG	20/1	1	2	20/1	SED BLDG LTG
SED BASIN LTG	20/1	3	4	20/1	SED BASIN LTG
SED BASIN LTG	20/1	5	6	20/1	SED BASIN RECPT
SED BASIN RECPT	20/1	7	8	20/1	SED BASIN RECPT
SED BASIN RECPT	20/1	9	10	20/1	SAMPLER 350-2180
COMMUNICATION SYSTEM	20/1	11	12	20/1	LP-S1
UH-610-2101 VIA MMP-650-4201	20/1	13	14	20/1	UH-610-2102 VIA MMP-650-4201
UH-610-2103 " "	20/1	15	16	20/1	UH-610-2104 " "
WEATHER STATION	20/1	17	18		SPACE
SPACE		19	20		
		21	22		
		23	24		

PANEL L8E LOCATION DIGESTER BLDG
VOLTAGE 120/208 PHASE 3 FEED
MOUNTING MCC 8E MAINS BRKR SIZE 100A (1)

CIRCUIT DESCRIPTION	BREAKER AMP/POLE	CKT NO	CKT NO	BREAKER AMP/POLE	CIRCUIT DESCRIPTION
DIG. CONT. RM LTG	20/1	1	2	20/1	EXTERIOR LTG
COMP RM LTG	20/1	3	4	20/1	BOILER RM LTG
STAIR LTG	20/1	5	6	20/1	LOWER LEVEL LTG (DIGESTER)
THICKENER LOWER LEVEL LTG	20/1	7	8	20/1	RECEPTACLES (DIGESTER)
DOOR OPERATOR	20/2	9	10	20/1	INCINERATOR PANEL
		11	12	20/1	CU H-630-8402
AIR CONTROL PANEL 1	20/1	13	14	20/1	ENG GEN NO.1 CONT PNL
AIR CONTROL PANEL 2	20/1	15	16	20/1	ENG GEN NO.2 CONT PNL (FLT)
CP-4	30/1	17	18	20/1	FIT-5222, DT-5212
FIT-5221, DT-5211	20/1	19	20	20/1	MMP-680-8401
UH-630-5201, 5202	20/1	21	22		SPARE
UH-630-5203, 5204	20/1	23	24	20/2	POLY FEED PUMP CNTRLR #2
POLY FEED PUMP CNTRLR #1	20/2	25	26		
		27	28	20/1	FLOT LOWER FLR RCPTS
FLOT. UPPER LEVEL RCPT	20/1	29	30	20/1	FLOT BXT EMERGENCY LTG
LSH-5441, -5442	20/1	31	32	30/1	FLOT UPPER FLR LTG
FLOT UPPER LEVEL LTG	30/1	33	34	20/1	ROWY LTG
SLUDGE LOADING RCPT	20/1	35	36	20/1	COMMUNICATIONS SYSTEM
UH'S 630-5401, 5402	20/1	37	38		SPARE
FE 610-5401, 5402	20/1	39	40	30/1	DIGESTER SIGHT GLASSES
FSL 5271, 5272	20/1	41	42	20/1	GAS LINE HEAT TRACING

RECORD DRAWINGS

Revisions Drawn by MJ POPPLETON Date NOV 1993

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OREGON REGISTERED PROFESSIONAL ENGINEER 5081 William F. Teeple RENEWAL 12-31-93

CH2M HILL

DESIGN D. HEINEKING
DR RE FREIER
CHK W. F. TEEPLE
APVD

NO.	DATE	REVISION	BY	APVD
2	11/3/93	RECORD DRAWING	MJP	RCF
1	3/1991	MISCELLANEOUS PLANT ADDITIONS- CONTRACT C9	CSR	RCF
	11/18/91	RECORD DRAWING	JPL	JBL
(1)	11/1989	ADDENDUM NO. 5	VAP	WFT

VERIFY SCALES
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0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

PANEL BOARD SCHEDULES

SHEET 900-E-3
DWG. NO. 424 OF 496
DATE MAY 1983
PROJ NO. P 15600.A1

900-E-3 900-E-3
900-E-3 900-E-3

FORMAT 381-2234 D/C
3 DM PRINTED 10 82 AZ
FILM KE

RECORD DRAWINGS

Revision Drawn By JM LOSTER Date NOV 1984

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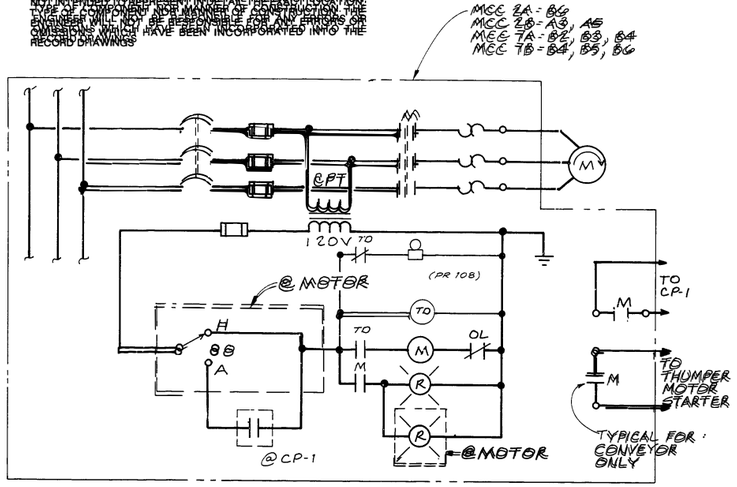
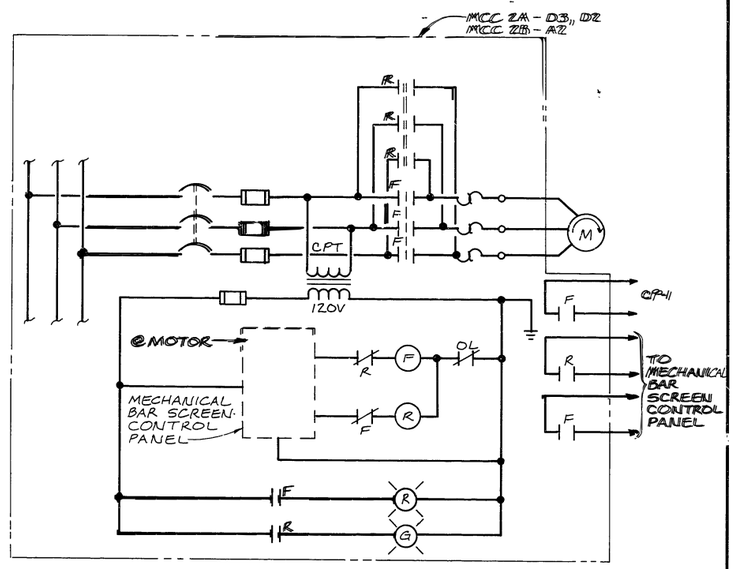
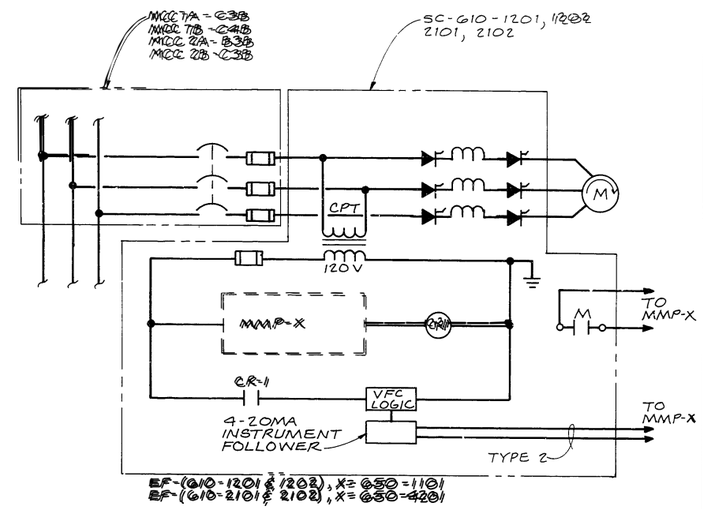


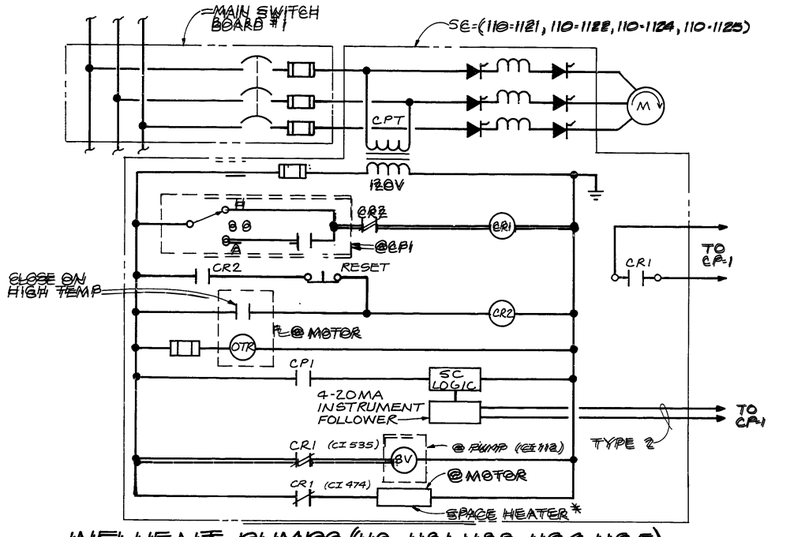
CLASSIFIER (330-1441 & 1442) CONVEYOR (330-1230) (EE 81)
HELICAL SCUM COLLECTOR (350-2131 THRU 2136)



MECHANICAL BAR SCREENS (310-1211 THRU 1213)

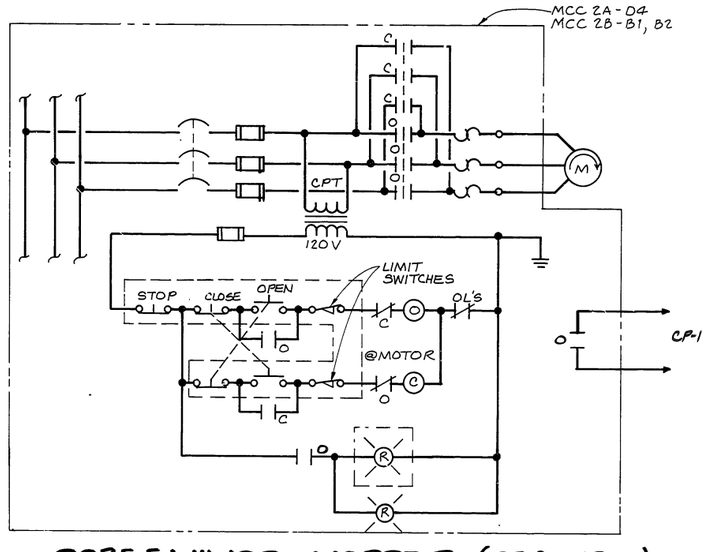


EF-(610-1201, 610-1202, 610-2101 & 610-2102)

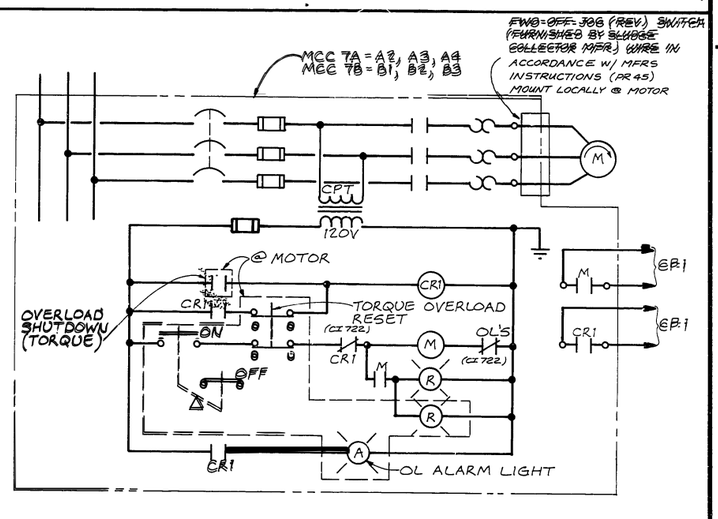


INFLUENT PUMPS (110-1121, 1122, 1124, 1125)

* PROVIDE POWER FROM CONTROL POWER TRANSFORMERS IN THE SPEED CONTROLLERS.



SCREENINGS HOPPER (350-1250)
GRIT HOPPER (350-1452 & 1451)



PRIMARY SLUDGE COLLECTORS (340-2111 THRU 2116)

REGISTERED PROFESSIONAL ENGINEER OREGON 5051 JULY 12, 1985 WILLIAM F. TOOLE

CH2M HILL

DSGN	TB Joyce
DR	M.T. WEBER
CHK	W.F. TOOLE
APVD	

NO.	DATE	REVISION	BY	APVD
		INITIAL RECORD DRAWING	JML	JBL

ERR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TRI-CITY SERVICE DISTRICT
CLACKAMAS COUNTY, OREGON
SEWAGE TREATMENT PLANT

ELEMENTARY DIAGRAMS

SHEET 900-E-11
DWG. NO. 431 OF 430
DATE MAY 1993
PROJ NO. P-15600.41

OVERLAY IDENTIFICATION: COMPOSITE / OVERLAY / SCREEN
PROJ NO.
CONTRACT

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FORMAT 381-2234MC