

REQUEST FOR BIDS



To be provided to the

SUPERIOR METROPOLITAN DISTRICT NO. 1

For the construction of

Superior's Rock Creek WWTF Anaerobic Zones Expansion

September 6, 2024

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PART 1 – REQUEST FOR BIDS

WORK: Rock Creek Wastewater Treatment Plant (WWTF) Anaerobic Zones Expansion

WORK NO.: PW 2024-05

SUBMITTAL DATE AND LOCATION:

Date of Request: September 6, 2024

Due Date for Bids: October 4, 2024 by 3:00 P.M. MST

Submit one copy of the Bid to:
Jim Widner, P.E.
Superior Metropolitan District No. 1
124 E. Coal Creek Drive
Superior, CO 80027

PRE-BID MEETING:

Date & Time: September 12, 10:00 A.M. MST

Location: Town Hall
124 E. Coal Creek Drive
Superior, CO 80027

Bidders are not required to attend the pre-bid meeting. A tour of the work site will follow the pre-bid meeting for those interested.

The Superior Metropolitan District No. 1 requests Bids for:

Superior’s Rock Creek WWTF Anaerobic Zones Expansion

Construction of new anaerobic zones at Superior’s Rock Creek Wastewater Treatment Facility (WWTF). This work generally consists of the following: demolition of existing storage room in existing treatment building, earthwork, site piping, and construction of concrete tankage with associated piping, slide gates, submersible mixers, and associated electrical.

Any questions concerning this Request for Bids shall be directed **IN WRITING ONLY** to the Engineer, Michael Syverson at Dewberry Engineers, Inc. Michael can be reached via email at msyverson@dewberry.com

Questions are due by: October 2, 2024, by 5:00 P.M. MST

PUBLISHED IN: Rocky Mountain E-Purchasing (BidNet Direct) & the Town of Superior’s website:
<https://www.superiorcolorado.gov>

PART 2 - INSTRUCTIONS TO BIDDERS

- 2.1 A "Bid" is a responsive, conforming, unconditional, complete, legible, and properly executed offer by a Bidder on the form supplied by the District to provide the work specified in the Request for Bids for the compensation specified.
- 2.2 Bids shall be clearly marked with the work name, contact person, mailing address, and telephone number of the Bidder.
- 2.3 It shall be the responsibility of the Bidder to ensure that the Bid is in proper form and in the District's possession by or before the time and date designated in the Request. Bids will not be accepted after the designated time and date. Any Bid received late will be returned to the Bidder unopened, if possible.
- 2.4 If a mistake is made or discovered during or after the Bid review, the District reserves the right to determine which party made the mistake and whether the mistake is material and, after these determinations, the District, in its sole reasonable discretion, shall decide whether to accept or reject the Bid. No advantage shall be taken by any party of manifest clerical errors or omissions in any Bid or the Contract Documents. Bidders shall notify the District immediately of any errors or omissions that are encountered.
- 2.5 Any interlineation, alteration, or erasure shall be initialed by the Bidder. On the Bid, the price of each item shall be stated in numerals and words; in case of conflict, the words shall control. In the case of conflict between the indicated sum of any addition of figures and the correct sum, the correct sum shall control.
- 2.6 The District shall not reimburse any Bidder for any cost incurred in preparing a Bid or attending equipment demonstrations, inspections, pre-bid conferences, or interviews.
- 2.7 Any amplification, clarification, explanation, interpretation, or correction of a Bid shall be made only by written addendum, and a copy of the addendum shall be mailed or delivered to each person receiving a Request for Bids. The District is not responsible for any amplification, clarification, explanation, or interpretation or correction of a Bid not contained in written addenda.
- 2.8 Bids by corporations shall be executed in the corporate name by the president or a vice-president (or a corporate officer accompanied by evidence of authority to sign), and the corporate seal shall be affixed and attested by the secretary or an assistant secretary. The corporate address and state of incorporation shall be shown. Bids submitted by partnerships shall be executed in the partnership name and signed by a partner, and the legal address of the partnership shall be shown. Bids submitted by limited liability companies shall be executed in the company's name and signed by a member, and the legal address of the company shall be shown. Names and titles shall be typed or printed below each signature.
- 2.9 The following information shall be submitted with the Bid:
 - 2.9.1 The names and resumes of staff personnel who will be assigned to the work.

- 2.9.2 A complete proposed scope of work and schedule, including any alternatives that can be identified. The Bidder is expected to review the work site prior to submittal of the Bid.
- 2.9.3 The names and addresses of any subcontractors who will be retained for the work.
- 2.9.4 A list of the Bidder's previous experience on construction of similar projects.
- 2.10 The submission of a Bid shall be conclusive evidence and a legal admission that the Bidder: (1) has no questions, complaints, or objections in connection with the Contract Documents, subject to any requests made by the Bidder for amplification, clarification, explanation, interpretation, or correction; (2) has no questions, complaints, or objections as to the completeness, sufficiency, scope, or detail of the Bid; and (3) has full knowledge of the scope, nature, quality, and quantity of the equipment to be provided, the performance criteria, the requirements of the Contract Documents, the site and conditions of delivery, the Superior Municipal Code, and other applicable law.
- 2.11 The contract will be awarded to the lowest responsible and responsive Bidder complying with the terms and conditions, guidelines, and specifications presented in the Bid Request and these Instructions to Bidders. The District reserves the right to determine, in its sole reasonable discretion, whether any Bid meets the needs or purposes intended and is within the approved budget. The District does not base its award on prices alone. Also to be considered are: quality of product; past experience with the Bidder or any subcontractors, consultants, products or suppliers; qualifications of the Bidder and/or subcontractors or suppliers; services offered; warranties; maintenance considerations; long-range costs; delivery; and similar conditions.
- 2.12. The District reserves the right to conduct such investigations as it deems necessary to assist in the evaluation of any Bid to establish the experience, responsibility, reliability, references, reputation, qualifications, or financial ability of any Bidder, manufacturer or supplier. The purpose of such investigation is to satisfy the District that the Bidder has the experience, resources, and commercial reputation necessary to supply the specified equipment and to perform the necessary warranty and product support in accordance with the Contract Documents in the prescribed manner and time.
- 2.13 Pursuant to C.R.S. § 8-19-101, if the District's appropriation or expenditure of moneys for the work may be reasonably expected to exceed \$500,000 in the aggregate for any fiscal year, a Colorado resident Bidder shall be allowed preference over a nonresident Bidder equal to the preference given or required by the state or foreign country in which the nonresident Bidder is a resident. Additional information may be obtained from the Colorado Department of Personnel & Administration web site.
- 2.14. The District reserves the right, if it deems such action to be in its best interests, to reject any and all Bids or to waive any irregularities or informalities therein. Any incomplete, false, or misleading information provided by any Bidder shall be grounds for rejection of the Bid. If Bids are rejected, the District further reserves the right to investigate and accept the next best Bid in order of ranking, or to reject all Bids and re-solicit for additional Bids.
- 2.15. No Bid shall include federal excise taxes or state or local sales or use taxes.

- 2.16. In the event of any claim, suit, or demand which may result from any Bid, or the award of any contract as a result of submission of a Bid, Colorado law shall govern any such claim, suit, or demand and the rights and duties of the parties.
- 2.17. The Bid, including all required documents, shall be submitted using the enclosed forms. The Summary and Bid Schedule shall be used for submitting the fees, and the completed forms shall be submitted in a separate sealed envelope. The Bidder shall also include with the Bid Schedule a breakdown of tasks that shows name, position, hours, and costs for each task.
- 2.18. Copies of the Contract Documents are available at the Superior Town Hall, 124 E. Coal Creek Drive, Superior, CO 80027.
- 2.19. All parts not specifically mentioned which are necessary in order to provide a complete unit, shall be included in the Bid. Any item listed as "Standard" in the manufacturer's published specification, furnished by the Bidder, is assumed to be included in the Bid. Any variations shall be outlined in writing, noting cost factors where applicable.
- 2.20. Bids shall be in accordance with the specifications contained in the attached Contract Documents. Should any requirement in the specifications not be included in manufacturer's specification sheets, the Bidder shall include with its Bid a statement of compliance. Failure to do so shall be grounds for disqualification of the Bid.
- 2.21. Each Bid shall include a statement of standard warranty of the manufacturer.
- 2.22. The District requires a Bid Bond in the form of a corporate surety bond in the amount of five percent of the total Bid amount before the District can accept and consider any Bid. Bids with the required bid bond shall be filed at Town Hall, 124 E. Coal Creek Drive, Superior, CO 80027, with the fee schedule, bid schedule, and bid summary in a separate sealed envelope. Upon award, such bid bonds shall be returned to the unsuccessful Bidder(s). For the successful Bidder, the bid bond will be returned upon receipt of the required payment and performance bond, in the full amount of the contract price.
- 2.23. Any Bid received as a result of this request is prepared at the Bidder's expense and becomes District property and is therefore a public record upon opening by the District. No Bid may be withdrawn for a period of 60 days after the deadline for Bids.

BID SCHEDULE

To: Jim Widner, P.E.
 Superior Metropolitan District No. 1
 124 E. Coal Creek Drive
 Superior, CO 80027

Work: Rock Creek WWTF Anaerobic Zones Expansion Project

BID: Pursuant to the request for bids for the above-named work and being familiar with all contractual requirements, therefore, the undersigned Bidder hereby proposes to furnish all labor, materials, tools, supplies, equipment, plant, transportation, services, and all other things necessary for the completion of the contractual work. All other work to complete the work but not specifically itemized shall also be included as incidental to the work cost. Contractor also agrees to pay all taxes and patent documents, within the time of completion of the contractual work and pay all taxes and patent costs, and perform the work in accordance with the time of completion set forth herein, for and in consideration of the following unit and lump sum prices:

Item	Description (major components)	Unit	Quantity	Unit cost	Total Amount
Base Bid					
1	Demolition of existing storage structure	LS	1	\$	\$
2	Earthwork	LS	1	\$	\$
3	Concrete	LS	1	\$	\$
4	Piping and appurtenances	LS	1	\$	\$
5	Mixer procurement and installation	LS	1	\$	\$
6	Slide gate procurement and installation	LS	1	\$	\$
7	Electrical	LS	1	\$	\$
Bid Alternate					
Total Bid if all 7 items provided (Sum of items 1-7)		LS	1	\$	\$

Notes: LS = lump sum.

The Superior Metropolitan District No. 1 has the right to award any one or all of these items at their choosing (Item #1 and any combinations of Items 2 through 7.

Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities against which the Contractor makes reasonable objection.

Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts.

BIDDER'S QUALIFICATION STATEMENT

A Statement showing the qualifications of Bidder shall be a prerequisite to the Bidder being awarded the Contract. The qualification statement is intended to assure the District that a high degree of overall workmanship can be expected, and that the Work will be completed within the time limits contained in the Contract Documents.

All items on the statement must be answered in full and submitted with the Bid. The qualification statement will be reviewed by the District after all Bids have been received and opened and prior to award.

The Bidder shall answer and furnish the following items for review:

1. Name of Bidder. _____

2. Permanent address and phone number of Bidder. _____

3. Date company was organized. _____

4. If a corporation, where incorporated. _____

5. Number of years engaged in contracting business under present firm or trade name. _____

6. Certified copy of financial statement prepared during current fiscal year as prepared for bank or bonding company.

7. List of current jobs new under contract, indicating client and telephone number, size, type of job and percentage of completion of each and date of completion. (Use additional sheets if necessary). _____

8. List of projects of this size and complexity completed within the last 3 years along with contract amount, client's name and address. _____

9. Have you ever failed to complete any work awarded to you? If so, when, where, and why? _____

10. Have you ever defaulted on a contract? If so, when, where, and why? _____

11. List your major equipment available for this contract. _____

BIDDER:

By: _____

STATE OF COLORADO)
) ss.
COUNTY OF _____)

The foregoing instrument was subscribed, sworn to and acknowledged before me this ___ day of _____, 20__, by _____, as _____ of _____.

My commission expires: _____

(SEAL)

Notary Public

CONSTRUCTION CONTRACT

THIS CONSTRUCTION CONTRACT (the "Contract") is made and entered into this ____ day of _____, 20__ (the "Effective Date"), by and between the Superior Metropolitan District No. 1, 124 East Coal Creek Drive, Superior, CO 80027, a Colorado special district (the "District"), and _____, an independent contractor with a principal place of business at _____ ("Contractor") (each a "Party" and collectively the "Parties").

For the consideration hereinafter set forth, the receipt and sufficiency of which are hereby acknowledged, the Parties agree as follows:

1. Scope of Work. Contractor shall perform the following described work (the "Work"), in accordance with this Contract and the Contract Documents, attached hereto and incorporated herein by this reference:

Construction of new anaerobic zones at the Superior's Rock Creek WWTF. This work generally consists of the following: demolition of existing storage room in existing treatment building, earthwork, site piping, and construction of concrete tankage with associated piping, slide gates, submersible mixers, and associated electrical.

2. Bonds. Within 10 days of the date of this Contract, Contractor shall provide the payment and performance bond and certificate of insurance required by the Contract Documents.

3. Commencement and Completion of Work. Contractor shall commence the Work within 10 days of date of the Notice to Proceed. Substantial Completion of the Work shall be accomplished by the ____ day of _____, 20__, unless the period for completion is extended otherwise in accordance with the Contract Documents. Final Completion of the Work shall be accomplished within _____ days of the date of Substantial Completion.

4. Compensation/Contract Price. The District agrees to pay Contractor, subject to all of the terms and conditions of the Contract Documents, for the Work, an amount not to exceed \$_____. The District shall pay Contractor in the manner and at such times as set forth in the General Provisions such amounts as required by the Contract Documents.

5. Keep Jobs In Colorado Act. Pursuant to the Keep Jobs in Colorado Act, C.R.S. § 8-17-101, *et seq.* (the "Act"), and the rules adopted by the Division of Labor of the Colorado Department of Labor and Employment implementing the Act (the "Rules"), Contractor shall employ Colorado labor to perform at least 80% of the work under this Contract and shall obtain and maintain the records required by the Act and the Rules. For purposes of this Section, "Colorado labor" means a person who is a resident of the state of Colorado at the time of this Contract, without discrimination as to race, color, creed, sex, sexual orientation, marital status, national origin, ancestry, age, or religion except when sex or age is a *bona fide* qualification. A resident of the state of Colorado is a person with a valid Colorado driver's license, a valid Colorado state-issued photo identification, or documentation that he or she has resided in Colorado for the last 30 days. Contractor represents that it is familiar with the requirements of the Act and the Rules and will fully comply with same. This Section shall not apply to any project for which appropriation or expenditure of moneys may be reasonably expected not to exceed \$500,000 in the aggregate for any fiscal year.

6. Governing Law and Venue. This Contract shall be governed by the laws of the State of Colorado, and any legal action concerning the provisions hereof shall be brought in Boulder County, Colorado.

7. No Waiver. Delays in enforcement or the waiver of any one or more defaults or breaches of this Contract by the District shall not constitute a waiver of any of the other terms or obligation of this Contract.

8. Integration. This Contract and any attached exhibits constitute the entire Contract between Contractor and the District, superseding all prior oral or written communications.

9. Third Parties. There are no intended third-party beneficiaries to this Contract.

10. Notice. Any notice under this Contract shall be in writing, and shall be deemed sufficient when directly presented or sent pre-paid, first class United States Mail, addressed to:

The District: Jim Widner, P.E.
Superior Metropolitan District No. 1
124 East Coal Creek Drive
Superior, CO 80027

Contractor: _____

11. Severability. If any provision of this Contract is found by a court of competent jurisdiction to be unlawful or unenforceable for any reason, the remaining provisions hereof shall remain in full force and effect.

12. Modification. This Contract may only be modified upon written agreement of the Parties.

13. Assignment. Neither this Contract nor any of the rights or obligations of the Parties shall be assigned by either party without the written consent of the other.

14. Governmental Immunity. The District and its officers, attorneys and employees are relying on, and do not waive or intend to waive by any provision of this Contract, the monetary limitations or any other rights, immunities, and protections provided by the Colorado Governmental Immunity Act, C.R.S. § 24-10-101, *et seq.*, as amended, or otherwise available to the District and its officers, attorneys or employees.

15. Rights and Remedies. The rights and remedies of the District under this Contract are in addition to any other rights and remedies provided by law. The expiration of this Contract shall in no way limit the District's legal or equitable remedies, or the period in which such remedies may be asserted, for work negligently or defectively performed.

16. Subject to Annual Appropriation. Consistent with Article X, § 20 of the Colorado Constitution, any financial obligation of the District not performed during the current fiscal year

is subject to annual appropriation, shall extend only to monies currently appropriated, and shall not constitute a mandatory charge, requirement or liability beyond the current fiscal year.

17. Federal Provisions.

A. *General.* The Parties acknowledge that the Agreement is subject to the provisions of 2 C.F.R. Part 200 for projects funded in whole or in part by federal funds and the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. § 5121, *et seq.*) for projects resulting from Declared Presidential Disasters.

B. *Equal Employment Opportunity.*

1. Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, or national origin. Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, or national origin. Such action shall include without limitation the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. Contractor shall post in conspicuous places, available to employees and applicants for employment, notices to be provided setting forth the provisions of this nondiscrimination clause.

2. Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, or national origin.

3. Contractor shall not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with Contractor's legal duty to furnish information.

4. Contractor shall send to each labor union or representative of workers with which Contractor has a collective bargaining agreement or other contract or understanding, a notice to be provided advising the said labor union or workers' representatives of Contractor's commitments under this Section, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

5. Contractor shall furnish all information and reports required by Executive Order 11246 and by rules, regulations, and orders of the Secretary of Labor pursuant thereto, and shall permit access to his books, records, and accounts by the administering agency and the

Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

6. In the event of Contractor's noncompliance with this section, this Agreement may be canceled, terminated, or suspended in whole or in part and Contractor may be declared ineligible for further government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

7. Contractor shall include these provisions in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor, so that such provisions will be binding upon each subcontractor or vendor. Contractor shall take such action with respect to any subcontract or purchase order as the administering agency may direct as a means of enforcing such provisions, including sanctions for noncompliance; provided, however, that in the event Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by the administering agency, Contractor may request the United States to enter into such litigation to protect the interests of the United States.

C. *Davis-Bacon Act and the Copeland "Anti-Kickback" Act.* Contractor shall comply with 40 U.S.C. § 3141-3144 and 40 U.S.C. § 3146-3148, as supplemented by 29 C.F.R. Part 5. set forth below.

1. Minimum Wages.

a. All laborers and mechanics will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 C.F.R. Part 3)), the full amount of wages and *bona fide* fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under § 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics. Regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed, without regard to skill. Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein, provided that the payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination and the Davis-Bacon poster (WH-1321) shall be posted at all times by Contractor and subcontractors at the work site in a prominent and accessible place where it can be easily seen by workers.

b. Contractor shall require that any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under this Agreement shall be classified in conformance with the wage determination. Contractor shall approve an additional classification and wage rate and fringe benefits therefore only when the following criteria have been met:

- i. The work to be performed by the classification requested is not performed by a classification in the wage determination; and
- ii. The classification is utilized in the area by the construction industry; and
- iii. The proposed wage rate, including any *bona fide* fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

c. If Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and Contractor agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by Contractor to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise Contractor, or notify Contractor that additional time is necessary.

2. If Contractor and the laborers or mechanics to be employed in the classification or their representatives do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), Contractor shall refer the questions, including the views of all interested parties and the recommendation of Contractor, to the Administrator for determination. The Administrator or an authorized representative will issue a determination within 30 days of receipt and so advise Contractor or will notify Contractor that additional time is necessary.

3. The wage rate (including fringe benefits where appropriate) determined pursuant to this Section shall be paid to all workers performing work in the classification under this Agreement from the first day on which work is performed in the classification.

4. Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, Contractor shall either pay the benefit as stated in the wage determination or shall pay another *bona fide* fringe benefit or an hourly cash equivalent thereof.

5. If Contractor does not make payments to a trustee or other third person, Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing *bona fide* fringe benefits under a plan or program; provided that that the Secretary of Labor has found, upon the written request of Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

6. The District shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from Contractor under this Agreement or any other federal contract with Contractor, or any other federally-assisted contract subject to Davis-Bacon prevailing wage requirements that is held by Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working on the site of the work, the District may, after written notice to Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased.

7. Payrolls and basic records.

a. Payrolls and basic records relating thereto shall be maintained by Contractor during the course of the work and preserved for a period of 3 years thereafter for all laborers and mechanics working at the site of the work. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in § 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of Labor has found under 29 C.F.R. 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in § 1(b)(2)(B) of the Davis-Bacon Act, Contractor shall maintain records that show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. If Contractor employs apprentices or trainees under approved programs, Contractor shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

b. Submittals.

i. Contractor shall submit weekly for each week in which any work is performed a copy of all payrolls to the applicant, sponsor, or owner, as the case may be, for transmission to the federal funding agency. The payrolls shall set out accurately and completely all of the information required to be maintained under 29 C.F.R. 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only include an individually identifying number for each employee. The required weekly payroll information may be submitted in any form desired. Contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractor and subcontractors shall maintain the full social security number and current address of each covered worker, and shall submit them to the District for transmission to the federal funding agency, Contractor, or the Wage and Hour

Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this section for Contractor to require a subcontractor to provide addresses and social security numbers to Contractor for its own records, without weekly submission to the sponsoring government agency or the applicant, sponsor, or owner.

ii. Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by Contractor or subcontractor or their agent who pays or supervises the payment of the persons employed under the Agreement, certifying the following: that the payroll for the payroll period contains the information required to be provided under § 5.5(a)(3)(ii) of 29 C.F.R. Part 5, the appropriate information is being maintained under § 5.5(a)(3)(i) of 29 C.F.R. Part 5, and that such information is correct and complete; that each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Agreement during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in Regulations, 29 C.F.R. part 3; and that each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Agreement.

iii. The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance".

iv. The falsification of any of the above certifications may subject Contractor or any subcontractor to civil or criminal prosecution under 31 U.S.C. § 231.

c. Contractor or subcontractor shall make the records required by this section on available for inspection, copying, or transcription by authorized representatives of the federal funding agency or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If Contractor or subcontractor fails to submit the required records or to make them available, the Federal agency may, after written notice to Contractor, sponsor, applicant, or owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 C.F.R. 5.12.

8. Apprentices and trainees.

a. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship Training, Employer and Labor Services, or with a State Apprenticeship Agency recognized by the Office, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in

the program, but who has been certified by the Office of Apprenticeship Training, Employer and Labor Services or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship Training, Employer and Labor Services, or a State Apprenticeship Agency recognized by the Office, withdraws approval of an apprenticeship program, Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

b. Except as provided in 29 C.F.R. 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration

withdraws approval of a training program, Contractor shall no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

c. Equal employment opportunity. The utilization of apprentices, trainees and journeymen under this part shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 C.F.R. part 30.

9. Contractor shall insert in any subcontracts the clauses contained in 29 C.F.R. 5.5(a)(1) through (10) and such other clauses as the federal funding agency may by appropriate instructions require, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all the contract clauses in 29 C.F.R. 5.5.

10. A breach of the clauses in 29 C.F.R. 5.5 may be grounds for termination of this Agreement, and for debarment as provided in 29 C.F.R. 5.12.

11. All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 C.F.R. parts 1, 3, and 5 are herein incorporated by reference in this Agreement.

12. Disputes concerning the labor standards provisions of this Agreement, including disputes between Contractor (or any of its subcontractors) and the contracting agency, the U.S. Department of Labor, or the employees or their representatives, shall be resolved in accordance with 29 C.F.R. parts 5, 6, and 7.

13. Certification of eligibility.

a. Contractor certifies that neither it nor any person or firm who has an interest in Contractor is a person or firm ineligible to be awarded government contracts by virtue of § 3(a) of the Davis-Bacon Act or 29 C.F.R. 5.12(a)(1).

b. No part of this Agreement shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of § 3(a) of the Davis-Bacon Act or 29 C.F.R. 5.12(a)(1).

c. The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. § 1001.

D. *Contract Work Hours and Safety Standards Act.* Contractor shall comply with the following:

1. Neither Contractor nor any subcontractor employing laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which they are employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than 1.5 times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

2. In the event of any violation of the clause set forth in subsection (1) hereof, Contractor and any subcontractor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of the clause set forth in subsection (1) hereof, in the sum of \$10 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of required overtime wages required.

3. The District shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by Contractor or subcontractor under any such contract or any other federal contract with the same Contractor, or any other federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages.

4. Contractor or subcontractor shall insert in any subcontracts the clauses set forth in this Section and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. Contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with this Section.

5. The requirements of 40 U.S.C. § 3704 apply. No laborer or mechanic may be required to work in surroundings or under working conditions which are unsanitary, hazardous or dangerous. These requirements do not apply to the purchases of supplies or materials or articles ordinarily available on the open market, or contracts for transportation or transmission of intelligence.

E. *Rights to Inventions Made.* If the federal award providing funding for this Agreement meets the definition of "funding agreement" under 37 C.F.R. § 401.2(a) and this Agreement is between the District and a small business firm or nonprofit organization regarding the substitution of parties, assignment, or performance of experimental, developmental, or research work under such funding agreement, the Parties shall comply with and be bound by 37 C.F.R. Part 401 and any implementing regulations issued by the awarding agency.

F. *Clean Air Act and Clean Water Act.* Contractor shall comply with the Clean Water Act and shall report each violation to the District, and understands and agrees that the District will, in turn, report each violation as required to assure notification to the State of Colorado, the federal awarding agency, and the appropriate Environmental Protection Agency Regional Office, and shall require all subcontractors to these requirements in each subcontract exceeding \$100,000 financed in whole or in part with a federal award. Contractor shall comply with the Federal Water Pollution Control Act and shall report each violation to the District and understands and agrees that the District will, in turn, report each violation as required to assure notification to the State of Colorado, federal awarding agency, and the appropriate Environmental Protection Agency Regional Office. Contractor agrees to include these requirements in each subcontract exceeding \$100,000 financed in whole or in part with a federal award.

G. *Energy Efficiency.* Contractor shall comply with mandatory standards and policies relating to energy efficiency contained in the state energy conservation plan issued in compliance with the Energy Policy and Conservation Act (42 U.S.C. § 6201), and shall include this clause in each third-party subcontract financed in whole or in part with federal assistance.

H. *Debarment and Suspension.*

1. Contractor affirms that neither it nor its principals are suspended or debarred or otherwise excluded from procurement by the Federal Government and do not appear in the SAM Exclusions, which is a list maintained by the General Services Administration.

2. If the Agreement is for \$25,000 or more:

a. Contractor verifies that neither Contractor nor its principals (defined at 2 C.F.R. §180.995) or affiliates (defined at 2 C.F.R. §180.905) are excluded (defined at 2 C.F.R. §180.940) or disqualified (defined at 2 C.F.R. §180.935);

b. Contractor shall comply with 2 C.F.R. Part 180, subpart C and must include a requirement to comply with these regulations in any lower tier covered transaction;

c. This certification is a material representation of fact relied upon by the District, and if it is later determined that Contractor did not comply with 2 C.F.R. Part 180, subpart C, in addition to remedies available to the State of Colorado and the District, the Federal Government may pursue available remedies, including without limitation suspension and debarment.

3. Throughout this Agreement, Contractor agrees to comply with the requirements of 2 C.F.R. Part 180, subpart C. Contractor agrees to include a provision requiring such compliance in its lower tiered covered transactions.

I. *Byrd Anti-Lobbying Amendment.* Contractors who apply or bid for an award of \$100,000 or more shall file the required certification set forth in the Certification Regarding Lobbying for the specific funding source. Each tier certifies to the tier above that it will not and has not used federal funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining a federal contract, grant, or any other award covered by 31 U.S.C. § 1352. Each tier shall also disclose any lobbying with non-federal funds that takes place in connection with obtaining any federal award. Such disclosures are forwarded from tier to tier up to the recipient.

J. *Procurement of Recovered Materials.* In the performance of this Agreement, where the purchase price of a product exceeds \$10,000 or the value of the quantity acquired by the preceding fiscal year exceeded \$10,000, Contractor shall make maximum use of products containing recovered materials that are EPA-designated items unless the product cannot be acquired: competitively within a timeframe providing for compliance with the Agreement performance schedule; meeting Agreement performance requirements; or at a reasonable price. Information about this requirement is available at EPA's Comprehensive Procurement Guidelines web site, <https://www.epa.gov/smm/comprehensive-procurement-guideline-cpg-program>. The list is <https://www.epa.gov/sites/production/files/2016-02/documents/cpg-fs.pdf>.

K. *Contracting with Small and Minority Businesses, Women's Business Enterprises, and Labor Surplus Area Firms.* If subcontracts are to be let, Contractor shall take the following affirmative steps to assure that minority businesses, women's business enterprises, and labor surplus area firms are used when possible:

1. Placing qualified small and minority businesses and women's business enterprises on solicitation lists;
2. Assuring that small and minority businesses, and women's business enterprises are solicited whenever they are potential sources;
3. Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses, and women's business enterprises;
4. Establishing delivery schedules, where the requirement permits, which encourage participation by small and minority businesses, and women's business enterprises; and
5. Using the services and assistance, as appropriate, of such organizations as the Small Business Administration and the Minority Business Development Agency of the Department of Commerce.

L. *Federal Law, Regulations, and Executive Orders.* Contractor acknowledges that funding under this Agreement may include federal, state, and local money, and that financial assistance from federal agencies will be used to fund specific projects under this Agreement only. For those projects, Contractor agrees to comply with all applicable law, rule, regulation, executive order, policies of the applicable federal funding agency, procedure, and directives.

M. *No Obligation by Federal Government.* The Federal Government is not a party to this Agreement and is not subject to any obligations or liabilities to the County, Contractor, or any other party pertaining to any matter resulting from the Agreement.

N. *Program Fraud and False or Fraudulent Statements or Related Acts.* Contractor acknowledges that 31 U.S.C. § 38 applies to this Agreement.

O. *Department of Homeland Security Seal, Logo, and Flags.* Contractor shall not use Department of Homeland Security ("DHS") seal(s), logos, crests, or reproductions of flags or likenesses of DHS agency officials without FEMA pre-approval.

P. *Housing and Community Development Act.*

1. The work to be performed under this Agreement is subject to Section 3 of the Housing and Urban Development Act of 1968, 12 U.S.C. § 1701u (Section 3). The Parties agree to comply with HUD's regulations in 24 CFR Part 135, which implement Section 3. The Parties certify that they are under no contractual or other impediment that would prevent them from complying with the Part 135 regulations.

2. Contractor agrees to send to each labor organization or representative or workers with which Contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of Contractor's commitments under the Section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.
3. Contractor shall include the Section 3 clause in every subcontract subject to compliance with regulations in 24 C.F.R. Part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this Section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 C.F.R. Part 135. Contractor shall not subcontract with any subcontractor where Contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 C.F.R. Part 135.
4. Contractor shall certify that any vacant employment positions, including training positions, that are filled (1) after Contractor is selected but before the Agreement is executed, and (2) with persons other than those to whom the regulations of 24 C.F.R. Part 135 require employment opportunities to be directed, were not filled to circumvent Contractor's obligations under 24 C.F.R. Part 135.
5. Noncompliance with 24 C.F.R. Part 135 may result in sanctions, termination of this Agreement for default, and debarment or suspension from future HUD-assisted contracts.
6. With respect to work performed in connection with Section 3 covered Indian housing assistance, § 7(b) of the Indian Self-Determination and Education Assistance Act. (25 U.S.C § 450e) applies to the work to be performed under this Agreement and requires that to the greatest extent feasible (i) preference and opportunities for training and employment shall be given to Indians, and (ii) preference in the award of contracts and subcontracts shall be given to Indian organizations and Indian-owned Economic Enterprises. Parties that are subject to the provisions of Section 3 and § 7(b) agree to comply with Section 3 to the maximum extent feasible, but in derogation of compliance with § 7(b).

NOTICE OF AWARD

Date: _____

Contractor Name

Address

RE: _____

Dear _____:

Thank you for submitting a Bid for the _____.

Your firm submitted the most qualified Bid and you have been selected as the successful Contractor. Accordingly, this is your Notice of Award for the _____.

Enclosed please find an original and duplicate original Construction Contract. Please review and sign both, then, within 10 days of receipt of this letter, return both to me along with your certification of insurance, payment and performance bond, each in the full amount of the Contract Price, and appropriate powers of attorney. When dating the above documents, please make sure that all dates, on all documents, are the same and that the insurance policy reflects the requirements of the Contract Documents. Please return all of the documents at the same time, in the same envelope.

Upon receipt of the signed Contracts, the District will execute both and return one fully executed original to you.

Should you have any questions, please call me at _____.

Sincerely,

_____, Project Manager

NOTICE TO PROCEED

Date: _____

Contractor Name

Address

RE: _____

Dear _____:

This letter is your Notice to Proceed, effective as of the date cited below. This notice is in reference to the Construction Contract between you and the Superior Metropolitan District No. 1 concerning the _____.

Please note that in accordance with the Construction Contract, Work must commence within ten days of the date of this Notice, and all Work must be substantially completed within _____ (_____) days of the date of this Notice, which shall be the ___ day of _____, 20__, and finally completed within _____ days of the date of this Notice, which shall be the ___ day of _____, 20_.

If you have any questions, please call me at _____.

Sincerely,

_____, Project Manager

Date

BID BOND

KNOW ALL MEN BY THESE PRESENTS

THAT _____, as PRINCIPAL, and _____ as SURETY, are held and firmly bound unto the Superior Metropolitan District No. 1, Colorado, hereinafter called OWNER, as Obligee, in the penal sum of _____ dollars (\$ _____), for the payment of which sum in lawful money of the United States, well and truly to be made, said PRINCIPAL and SURETY bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the PRINCIPAL has submitted a Bid to OWNER for certain Work or services generally described as follows: _____

NOW, THEREFORE, (a) if said Bid shall be rejected, or (b) if said Bid shall be accepted and the PRINCIPAL is awarded the Contract and, within the time and manner specified in the Contract Documents, enters into a written Contract in the prescribed form and shall give such bond or bonds as may be specified in the Contract Documents to guarantee faithful performance of such Contract and to guarantee prompt payment of labor and materials furnished in the prosecution thereof, and shall provide to OWNER a Certificate of Insurance as required by the Contract Documents, and shall in all other respects perform the Contract created by the acceptance of said Bid, or (c) in the event of the failure of the PRINCIPAL to enter such Contract and to give such bond or bonds, and Certificate of Insurance, if the PRINCIPAL shall pay to OWNER the difference not to exceed the penalty hereof between the amount specified in said Bid and such larger amount for which the OWNER 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 it shall be and remain in full force and effect.

The SURETY, for value received, hereby stipulates and agrees that the obligations of said SURETY hereunder shall be in no way impaired or affected by any alteration or irregularities in the bid or in the bidding procedure or by any extension of time within which OWNER may accept such Bid, and does hereby waive notice of same.

Dated this _____ day of __, 20__.

(SURETY) (PRINCIPAL)

By: _____
Title: _____

By: _____
Title: _____

(ACKNOWLEDGMENTS AND POWER OF ATTORNEY TO BE ATTACHED)
CORPORATE SEAL MUST BE AFFIXED IF PRINCIPAL IS A CORPORATION.

PAYMENT AND PERFORMANCE BOND

Bond No. _____

KNOW ALL MEN BY THESE PRESENTS: that

(Firm) _____

(Address) _____

(an Individual), (a Partnership), (a Corporation), hereinafter referred to as "the Principal", and

(Firm) _____

(Address) _____

hereinafter referred to as "the Surety", are held and firmly bound unto the Superior Metropolitan District No. 1, Colorado, a Municipal Corporation, hereinafter referred to as "the Owner", in the penal sum of _____ Dollars in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITIONS OF THIS OBLIGATION are such that whereas the Principal entered into a certain Contract with the Owner, dated the ____ day of _____, 20____, a copy of which is hereto attached and made a part hereof for the performance of the Work, _____.

NOW, THEREFORE, if the Principal shall well, truly and faithfully perform its duties, all the undertakings, covenants, terms, conditions and agreements of said Contract during the original term thereof, and any extensions thereof which may be granted by the Owner, with or without Notice to the Surety and during the life of the guaranty or warranty period, and shall satisfy all claims and demands incurred under such Contract, and shall fully indemnify and save harmless the Owner from all cost and damages which it may suffer by the Principal's failure to do so, and shall reimburse and repay the Owner all outlay and expense which the Owner may incur in making good any default, and make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such Contract, and any authorized extension or modification thereof, including all amounts due for materials, lubricants, repairs on machinery, equipment and tools, consumed, rented or used in connection with the construction of such work, and all insurance premiums on said work, and for all labor performed in such work, whether by subcontractor or otherwise, then this obligation shall be void; otherwise it shall remain in full force and effect.

PROVIDED, FURTHER, that the said Surety, for value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the Work to be performed thereunder or the specifications accompanying the same shall in any way affect its obligation on this Bond; and it does hereby waive notice of any such change, extension of time, alteration or addition to the terms of the Contract or to the Work or to the Specifications.

PROVIDED, FURTHER, that no final settlement between the Owner and the Principal shall abridge the right of any beneficiary hereunder whose claim may be unsatisfied.

IN WITNESS WHEREOF, this instrument is executed in 5 counterparts, each one of which shall be deemed an original, this _____ day of _____, 20_____.

ATTEST:

PRINCIPAL

By: _____

By : _____

Title: _____

Title: _____

Address: _____

(Corporate Seal)

SURETY

ATTEST:

Surety: _____

By: _____

By: _____

Attorney-in-Fact: _____

Title: _____

Address: _____

(Surety Seal)

NOTE: Date of Bond must not be prior to date of Contract and Surety must be authorized to transact business in the State of Colorado and be acceptable to the District.

CERTIFICATE OF FINAL PAYMENT

With reference to Contract Number _____ dated _____, 20__, between the undersigned Contractor and the Superior Metropolitan District No. 1, for: _____ at Superior, Colorado

The undersigned hereby certifies that all costs, charges and expenses incurred by it on its behalf for work, labor, services, materials and equipment supplied to the foregoing premises, and/or used in connection with its Work under the Contract have been duly paid.

The undersigned further certifies that to its best knowledge and belief (based upon reasonable investigation) each of its subcontractors and material men have duly paid all costs, charges and expenses incurred by them or on their behalf for work, labor, services, materials and equipment supplied to the foregoing premises and/or used by them in connection with the Undersigned's Work under the Contract.

In consideration of _____ dollars (\$_____) representing final payment under the Contract, the undersigned hereby releases and discharges the Owner and Owner's property from all claims, liens and obligations of every nature arising out of or in connection with the performance of the Work.

As additional consideration for the final payment, and to the fullest extent permitted by law, the undersigned agrees to indemnify and hold harmless Owner from and against all costs, losses, damages, claims, causes of action, judgments and expenses arising out of or in connection with claims against Owner which may be asserted by the undersigned or any suppliers, subcontractors of any tier or any of their representatives, officers, agents and employees for the costs, losses, damages, claims, causes of action, judgments and expenses and expenses that are attributable to the act, omission, error, professional error, mistake, negligence or other fault of the undersigned.

The foregoing shall not relieve the Undersigned of its obligations under the provisions of the Contract as amended, which by their nature survive completion of the Work including, without limitation, warranties, guarantees and indemnities.

Executed this _____ day of _____, 20__.

Contractor

CERTIFICATE OF FINAL ACCEPTANCE

TO: _____ Date: _____
Project No.: _____
Project Title: _____

This is to advise you that a final inspection of the referenced Work has been made and all work and material was found to be satisfactory. Therefore, the Work is considered to be complete in accordance with the approved plans, specifications and contract documents.

In accordance with the Contract, all Warranty periods shall begin as of the date of this letter.

SUPERIOR METROPOLITAN DISTRICT NO. 1

By: _____
Title: _____

GENERAL PROVISIONS

PART 1. DEFINITIONS

1.01 CONTRACT DOCUMENTS:

- A. Bid Form (Including Bid Summary);
- B. Bid Schedule;
- C. Bidder's Qualification Statement;
- D. Construction Contract;
- E. General Provisions
- F. Special Provisions;
- G. Technical Specifications;
- H. Construction Drawings;
- I. Certificate of Insurance Verification;
- J. Notice of Award;
- K. Notice to Proceed;
- L. Bid Bond;
- M. Payment and Performance Bond;
- N. Certificate of Final Payment;
- O. Final Acceptance Form;
- P. Documentation submitted by Contractor prior to Notice of Award; and
- Q. Addenda through.

1.02 CHANGE ORDER:

A written order issued by the District after execution of the Contract authorizing an addition, deletion or revision in the Work, or an adjustment in the Contract Price or the Contract Time.

1.03 DISTRICT:

The Superior Metropolitan District No. 1, Colorado.

1.04 CONTRACT:

The entire written agreement covering the performance of the Work described in the Contract Documents including all supplemental agreements thereto and all general and special provisions pertaining to the Work and materials therefor.

1.05 CONTRACT PRICE:

The amount set forth in Paragraph 4 of the Construction Contract.

1.06 CONTRACT TIME:

The time for completion of the Work as set forth in Paragraph 3 of the Construction Contract.

1.07 DAY:

Calendar day, unless otherwise specified. When the last day for the occurrence of an event falls on a Sunday or legal holiday as recognized by the District, the time for performance shall be automatically extended to the next business day.

1.08 FINAL COMPLETION:

The date as certified by the Project Manager when all of the Work is completed and final payment may be made.

1.09 PROJECT MANAGER:

The District's duly authorized representative in connection with the Work.

1.10 SUBCONTRACTOR:

Any person, firm or corporation with a direct contract with Contractor who acts for or on behalf of Contractor in executing any part of the Contract, excluding one who merely furnishes material.

1.11 SUBSTANTIAL COMPLETION:

The date as certified by the Project Manager when the District occupies or takes possession of all or substantially all of the Work, or when the District may occupy or take possession of all or substantially all of the Work and put it to beneficial use for its intended purposes.

1.12 WORK:

All the work specified, indicated, shown or contemplated in the Contract Documents, including all alterations, amendments or extensions thereto made by supplemental agreements or written orders of the Project Manager.

PART 2. TIME

2.01 TIME OF THE ESSENCE:

All times stated in the Contract Documents are of the essence.

2.02 FINAL ACCEPTANCE:

Upon Final Completion, the Project Manager will issue final acceptance.

2.03 CHANGES IN THE WORK:

The District reserves the right to order changes in the Work, in the nature of additions, deletions or modifications, without invalidating the Contract, and to make corresponding adjustments in the Contract Price and the Contract Time. All changes shall be authorized by a written Change Order signed by the Project Manager. The Change Order shall include appropriate changes in the Contract Documents and the Contract Time. The Work shall be changed and the Contract Price and Contract Time modified only as set forth in the written Change Order. Any adjustment in the Contract Price resulting in a credit or a charge to the District shall be determined by mutual agreement of the parties before the work set forth in the Change Order is commenced. If a Change Order results in an increase in the Contract Price, approval of the Superior Board of Trustees shall be required, and if such approval is not obtained, the District shall have no payment obligation regardless of whether the Work pursuant to the Change Order has been performed.

2.04 DELAYS:

A. If Contractor is delayed in the progress of the Work by fire, unusual delay in transportation, unanticipated adverse weather conditions, or other unavoidable casualties beyond Contractor's control other than unanticipated adverse weather conditions, the Contract Time shall be extended for a reasonable period of time. "Weather" means precipitation, temperature, or wind, and an "adverse weather condition" means weather that on any calendar day varies from the average weather conditions for that day by more than 100% as measured by the National Oceanic and Atmospheric Administration. The term "unanticipated adverse weather conditions" means the number of days in excess of the anticipated adverse weather days per month as set forth below:

MONTHLY ANTICIPATED ADVERSE WEATHER DAYS

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
7	4	4	4	6	3	4	2	3	3	2	5

By reason of example only, if in March there are two days when the snowfall exceeds the average snowfall for that day by 100%, those two days will have experienced an adverse weather condition. However, there will have been no unanticipated adverse weather condition in March, because there are four anticipated adverse weather days in March, which should be accounted for in the schedule. If, however, there are five days in which the snowfall exceeds the average snowfall by 100%, an unanticipated adverse weather condition will have occurred, and Contractor shall be entitled to request an extension of time.

B. Any request for extension of the Contract Time shall be made in writing to the Project Manager not more than 7 days after commencement of the delay; otherwise it shall be waived. Any such request shall contain an estimate of the probable effect of such delay on the progress of the Work.

C. Contractor shall not be entitled to any increase in the Contract Price, or to damages, or to additional compensation as a consequence of any such delays.

2.05 NO DAMAGES FOR DELAY:

In strict accordance with C.R.S. § 24-91-103.5, the District shall not amend the Contract Price to provide for additional compensation for any delays in performance which are not the result of acts or omissions of the District or persons acting on behalf of the District.

PART 3. CONTRACTOR'S RESPONSIBILITIES

3.01 COMPLETION/SUPERVISION OF WORK:

Contractor hereby warrants that it is qualified to assume the responsibilities and render the services described herein and has all requisite corporate authority and licenses in good standing. The services performed by Contractor shall be in accordance with generally accepted professional practices and the level of competency presently maintained by others in the same or similar type of work, and in compliance with applicable laws, ordinances, rules and regulations. Contractor shall be responsible for completion of all Work in a timely and workmanlike manner in accordance with the terms and specifications of the Contract Documents, including the techniques, sequences, procedures and means. Contractor shall be responsible for the coordination of all Work. Contractor shall supervise and direct the Work and give it all attention necessary for proper supervision and direction. Contractor shall maintain a supervisor on site at all times when Contractor or any subcontractor is performing Work.

3.02 DUTY TO INSPECT:

Contractor shall inspect all Contract Documents, tests and reports, including soil tests and engineering tests, if applicable, and shall conduct a site or field review prior to executing the Contract. Contractor assumes the risk of all conditions which are disclosed, or which are reasonably suggested by any such tests or reports, or which would be disclosed by a field or site review. Contractor shall have the affirmative duty to advise the District of any concerns which Contractor may have regarding construction conditions prior to executing the Contract.

3.03 FURNISHING OF LABOR AND MATERIALS:

A. Contractor shall provide and pay for all labor, materials and equipment, including: tools; construction equipment and machinery; utilities, including water; transportation; and all other facilities and services necessary for the proper completion of the Work.

B. In all purchases of supplies, materials and provisions to be incorporated or otherwise used by Contractor in the Work, Contractor shall use supplies, materials and provisions produced, manufactured or grown in Colorado if such supplies, materials and provisions are not of inferior quality to those offered by competitors outside of Colorado.

C. While engaged in the performance of the Work, Contractor shall maintain employment practices that do not violate the provisions of the Colorado Antidiscrimination Act of 1957, C.R.S. § 24-34-301, *et seq.*

3.04 EMPLOYEES AND SAFETY:

A. Contractor shall maintain at all times strict discipline of its employees, and Contractor shall not employ on the Work any person unfit or without sufficient knowledge, skill, and experience to perform properly the job for which the employee was hired.

B. Contractor shall be responsible to the District for the acts, negligence and omissions of all direct and indirect employees and subcontractors. The Contract Documents shall not be construed as creating any contractual relation between any subcontractor and the District.

C. Contractor shall provide for and oversee all safety orders and precautions necessary for the safe performance of the Work. Contractor shall take reasonable precautions for the safety of all employees and others whom the Work might affect, all work and materials incorporated into the Work, and all property and improvements on the work site and adjacent property.

3.05 CLEANUP:

A. Contractor shall keep the work site and adjoining ways free of waste material and rubbish caused by its employees or subcontractors. Contractor shall remove all such waste material and rubbish daily during construction, together with all tools, equipment, machinery and surplus materials. Contractor shall, upon termination of its Work, conduct general cleanup operations on the work site, including the cleaning of all surfaces, paved streets and walks, and steps. Contractor shall also conduct such general cleanup operations on adjacent properties which were disturbed by the Work.

B. If Contractor fails to perform the cleanup required by this Section, after written notice, the District may cause the cleanup to be performed at Contractor's expense. Upon receipt of a statement for such cleanup, Contractor shall pay to the District the costs incurred by the District for such cleanup, or the District shall have the right to withhold said amount from any final payment due to Contractor.

3.06 PAYMENT OF ROYALTIES AND LICENSE FEES:

Contractor agrees to pay all royalties and license fees necessary for the Work, and to defend against all actions for infringement of copyright or patent rights, and to save and hold the District harmless from such actions.

3.07 TAXES, LICENSES AND PERMITS:

Contractor shall pay all taxes imposed by law in connection with the Work, except the Town of Superior Sales Tax, for purchases within the District, and shall procure all permits and licenses necessary for the prosecution of the Work. Contractor shall obtain a Town tax-exempt number for the sales tax exemption.

3.08 SAMPLES AND SHOP DRAWINGS:

Contractor shall furnish, upon the request of the Project Manager, samples and shop drawings to the Project Manager, who shall review them for conformance with the Contract Documents. All Work shall comply with approved samples and drawings.

3.09 COMPLIANCE WITH LAWS AND REGULATIONS:

Contractor shall comply with all federal, state and local laws, ordinances, rules, regulations and orders in any manner relating to the Work. If any provision of the Contract Documents is at variance therewith, Contractor shall notify the Project Manager promptly.

3.10 SUBCONTRACTORS:

A. Contractor shall furnish to the Project Manager at the time the Construction Contract is executed, a list of names of subcontractors to whom Contractor proposes to award the portions of the Work to be subcontracted by Contractor.

B. Contractor shall not employ a subcontractor to whose employment the District reasonably objects, nor shall Contractor be required to hire a subcontractor to whose employment Contractor reasonably objects.

C. All contracts between Contractor and subcontractor shall conform to the provisions of the Contract Documents, and shall incorporate the relevant provisions of the Contract Documents.

3.11 CORRECTIVE WORK:

When any Work does not conform to the Contract Documents, Contractor shall make the necessary corrections so that the Work will so conform. Such corrections shall be accomplished within the time period approved by the Project Manager. Failure to complete such required corrections within the time period required shall constitute a breach of the Contract. The District's review, approval or acceptance of, or payment for any work shall not be construed as a waiver of any rights under this Contract or any cause of action arising out of the performance of this Contract.

3.12 OTHER CONTRACTS:

The District reserves the right to let other contracts in connection with the Work. Contractor shall cooperate with all other contractors so that their work is not impeded by the Work, and Contractor shall give other contractors access to the work site necessary to perform their contracts.

3.13 COMMUNICATION:

Contractor shall direct all communications to the District regarding the Work to the attention of the Project Manager.

PART 4. TERMINATION

4.01 LABOR DISPUTES:

Notwithstanding any other provision contained in this Contract, in the event of any picket or other form of labor dispute at the construction site, Contractor shall continue to perform the Work without interruption or delay. If Contractor ceases performance of the Work because of such picket or other form of labor dispute, the District may terminate the services of Contractor after giving 48 hours' written notice of its intent to do so.

4.02 DEFAULT:

The District may terminate this Contract upon thirty days' written notice to Contractor if Contractor defaults in the timely performance of any provision of the Contract Documents, or otherwise fails to perform the Work, or any part thereof, in accordance with the Contract Documents. Termination of the Contract by the District shall not be the District's exclusive remedy, and the District may pursue such other remedies and actions lawfully available to the District including, but not limited to, an action at law for damages against Contractor or any bonding agency issuing a bond hereunder, or an action in equity for injunctive relief.

PART 5. WARRANTIES:

5.01 WARRANTY OF FITNESS OF EQUIPMENT AND MATERIALS:

Contractor represents and warrants to the District that all equipment and materials used in the Work, and made a part of the Work, or placed permanently in the Work, shall be new unless otherwise specified in the Contract Documents. All equipment and materials used shall be of good quality, free of defects and in conformity with the Contract Documents. All equipment and materials not in conformity with the Contract Documents shall be considered defective.

5.02 GENERAL WARRANTY:

Contractor shall warrant and guarantee all material furnished and work performed by Contractor for a period of two years from the date of final acceptance of the Work by the Project Manager. Under this warranty, Contractor agrees to repair or replace, at its own expense and under the direction of the Project Manager, any portion of the Work which fails or is defective, unsound, unsatisfactory because of materials or workmanship, or which is not in conformity with the provisions of the Contract. Should Contractor fail to perform any such work within the warranty period after a request by the District, the District may withdraw from the Payment and Performance Bond any and all amounts necessary to complete the required work. The expiration of the warranty period shall in no way limit the District's legal or equitable remedies, or the period in which such remedies may be asserted, for work negligently or defectively performed.

PART 6. BONDS, INSURANCE AND INDEMNIFICATION

6.01 INDEMNIFICATION:

A. Contractor agrees to indemnify and hold harmless the District and its officers, insurers, volunteers, representatives, agents, employees, heirs and assigns from and against all claims, liability, damages, losses, expenses and demands, including attorney fees, on account of injury, loss, or damage, including, without limitation, claims arising from bodily injury, personal injury, sickness, disease, death, property loss or damage, or any other loss of any kind whatsoever, which arise out of or are in any manner connected with this Contract or the Contract Documents, to the extent that such injury, loss or damage is attributable to the act,

omission, error, professional error, mistake, negligence or other fault of Contractor, any subcontractor of Contractor, or any officer, employee, representative, or agent of Contractor or of any subcontractor of Contractor, or which arise out of any worker's compensation claim of any employee of Contractor or of any employee of any subcontractor of Contractor.

B. Contractor, to the fullest extent permitted by law, shall defend, investigate, handle, respond and provide defense for and defend against any such liability, claims, damages, losses, expenses or demands at the sole expense of Contractor, or at the option of the District, Contractor agrees to pay the District or reimburse the District for defense costs incurred by the District in connection with any such liability, claims, damages, losses, expenses or demands. Contractor, to the fullest extent permitted by law, shall defend and bear all other costs and expenses related thereto, including court costs and attorney fees, whether or not such liability, claims or demands alleged are groundless, false or fraudulent.

C. This indemnification provision is intended to comply with C.R.S. § 13-21-111.5(6) and shall be read as broadly as permitted to satisfy that intent. Contractor's liability under this provision shall be to the fullest extent of, but shall not exceed, that amount represented by the degree or percentage of negligence or fault attributable to Contractor, any subcontractor of Contractor, or any officer, employee, representative, or agent of Contractor or of any subcontractor of Contractor. If Contractor is providing architectural, engineering, surveying or other design services under this Agreement, the extent of Contractor's obligation to defend, indemnify and hold harmless the District may be determined only after Contractor's liability or fault has been determined by adjudication, alternative dispute resolution or otherwise resolved by mutual agreement of the Parties, as provided by C.R.S. § 13-50.5-102(8)(c).

6.02 NOTICE OF CLAIM:

If Contractor receives any claim arising from the performance of the Work, Contractor shall notify the District in writing of the nature of the claim within 24 hours of receipt of the claim by Contractor. In this notice, Contractor shall provide evidence that Contractor has notified Contractor's insurer of the claim. Contractor shall keep the District apprised of the disposition of the claim, and Contractor shall take all necessary action to resolve the claim and make restitution, if required, as quickly as possible.

6.03 INSURANCE:

A. Contractor agrees to procure and maintain, at its own cost, a policy or policies of insurance sufficient to insure against all liability, claims, demands, and other obligations assumed by Contractor pursuant to this Contract. At a minimum, Contractor shall procure and maintain, and shall cause any subcontractor to procure and maintain, the insurance coverages listed below, with forms and insurers acceptable to the District.

1. Worker's Compensation insurance as required by law.

2. Commercial General Liability insurance with minimum combined single limits of \$1,000,000 each occurrence and \$2,000,000 general aggregate. The policy shall be applicable to all premises and operations, and shall include coverage for bodily injury, broad form property damage, personal injury (including coverage for contractual and employee acts), blanket contractual, products, and completed operations. The policy shall contain a severability of interests provision, and shall include the District and the District's officers, employees, and contractors as additional insureds. No additional insured endorsement shall contain any exclusion for bodily injury or property damage arising from completed operations.

B. Such insurance shall be in addition to any other insurance requirements imposed by law. The coverages afforded under the policies shall not be canceled, terminated or materially changed without at

least 30 days prior written notice to the District. In the case of any claims-made policy, the necessary retroactive dates and extended reporting periods shall be procured to maintain such continuous coverage. Any insurance carried by the District, its officers, its employees, or its contractors shall be excess and not contributory insurance to that provided by Contractor. Contractor shall be solely responsible for any deductible losses under any policy.

C. Contractor shall provide to the District a certificate of insurance as evidence that the required policies are in full force and effect. The certificate shall identify this Contract.

6.04 PERFORMANCE AND PAYMENT BOND:

Contractor shall furnish a Payment and Performance Bond in the full amount of the Contract Price, as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents, including the warranty. This bond shall remain in effect at least until two years after the date of Final Completion.

PART 7. PAYMENT

7.01 PROGRESS PAYMENTS:

A. The District shall make periodic progress payments to Contractor within 30 days following the Project Manager's approval of the Work completed. A progress payment shall be made only after Contractor has submitted an application for a progress payment on a form approved by the Project Manager, and if requested by the Project Manager, Contractor shall submit copies of invoices from subcontractors or supplies and partial waivers executed by each.

B. Progress payments shall be in an amount equal to 95% of the Work actually completed. Completed Work shall include materials and equipment not incorporated in the Work but delivered to the work site and suitably stored.

C. If Contractor fails to complete any required Work within the time period agreed between Contractor and the Project Manager, or within any time period set forth in the Contract Documents, as modified or extended, the District is expressly authorized to withhold any progress payment for such Work until such Work is completed.

7.02 FINAL PAYMENT:

Upon final acceptance of the Work, the District shall make final payment to Contractor pursuant to C.R.S. § 38-26-107.

7.03 LIQUIDATED DAMAGES:

A. Because time is of the essence and delayed performance constitutes a compensable inconvenience to the District and its residents, the liquidated damages established in this Section shall be enforced. Such damages are not a penalty. For each day Final Completion is delayed after the Final Completion date stated in the Construction Contract, as modified through approved change orders, Contractor shall be assessed the following amounts:

Contract Price	Amount per day
\$0-\$50,000	\$350
\$50,000-\$100,000	\$380
\$100,000-\$250,000	\$440
\$250,000-\$500,000	\$520
\$500,000-\$1,000,000	\$640
\$1,000,000-\$2,000,000	\$820
\$2,000,000-\$4,000,000	\$1,080
\$4,000,000-\$8,000,000	\$1,450
\$8,000,000-\$12,000,000	\$1,820
\$12,000,000 or greater	\$2,250

B. Allowing Contractor to continue and finish the Work or any part thereof after the Final Completion date shall not operate as a waiver on the part of the District of any of its rights under the Contract Documents. Any liquidated damages assessed shall not relieve Contractor from liability for any damages or costs of other contractors caused by a failure of Contractor to complete the Work in the Contract Time. Liquidated damages may be deducted from any payment due Contractor or the retainage. If the liquidated damages exceed the amount owed to Contractor, Contractor shall reimburse the District.

7.04 ORAL AGREEMENTS PROHIBITED:

This Contract is expressly subject to the provisions of C.R.S. § 29-1-110(1), and Contractor acknowledges that neither the District nor any employee or agent thereof is authorized to expend or contract for the expenditure of any monies in excess of those appropriated by the Superior Board of Trustees. The District acknowledges that sufficient funds have been appropriated to pay the Contract Price, but Contractor shall not rely upon the appropriation of any funds in addition to those already appropriated unless and until the same are lawfully appropriated by the Superior Board of Trustees.

7.05 ITEMS NOT INCLUDED IN BID:

No additional compensation shall be paid for any costs or services listed in the Contract Documents but not specifically listed in the Bid as a Bid item.

7.06 CHANGES IN QUANTITY:

- A. Except as provided in Section 7.07, the unit Bid price shown in the Bid Schedule shall be used to determine the payment owed Contractor for any changes in quantity.
- B. The actual quantity placed, as determined by the Project Manager, shall be used to calculate the payment due to Contractor.
- C. Prior to any Work being performed in excess of any of the Bid Schedule quantities, Contractor shall notify the District, in writing, of every quantity that will exceed 105% of the quantity listed on the Bid Schedule.
- D. Except as provided in Section 7.08, Contractor shall not be entitled to compensation for any increased expense, loss of expected reimbursement or loss of anticipated profits, directly or indirectly caused by any changes in quantity.

7.07 BID PRICE ADJUSTMENTS:

- A. When a major item is increased to more than 125% or decreased below 75% of the original quantity stated on the Bid Schedule, the unit Bid price shall be modified by written

change order. Payment for major items shall be calculated by multiplying the actual quantity placed by the modified Bid price.

B. For purposes of this Section, a major item is any item having a Bid value, determined by multiplying the Bid quantity by the unit Bid price, that exceeds 10% of the original Contract Price.

7.08 ELIMINATED ITEMS:

Should any items contained in the Bid Schedule be found unnecessary for completion of the Work, the items shall be eliminated. The Contract Price shall be modified through written change order, and the amount of the change order shall be the eliminated quantity multiplied by the unit Bid price stated in the Bid Schedule, minus any reasonable costs incurred by Contractor for the eliminated items. Reasonable costs shall be determined by the Project Manager based on information provided by Contractor, and may include mobilization of eliminated materials and equipment mobilization costs, if the sole purpose of the equipment was to place the eliminated material. In no case shall the costs exceed the amount of the eliminated items.

7.09 MATERIALS STORED BUT NOT INCORPORATED:

Payments may be made to Contractor for materials stored on the work site but not incorporated into the Work as evidenced by invoices or cost analyses of material produced if the material has been fabricated or processed and is ready for installation into the Work and conforms with the Contract Documents. Payments shall not exceed 85% of the price shown in the Bid Schedule or 100% of the certified invoice cost of the stockpiled material, whichever is less. Payment for stockpiled materials shall not relieve Contractor of responsibility for loss or damage to the material. Payment for living plant materials or perishable materials shall not be made until the living or perishable material is made an integral part of the finished Work.

7.10 COST RECORDS:

Contractor shall make cost records available to the District if the District deems it necessary to determine the validity and amount of any item claimed.

PART 8. MISCELLANEOUS

8.01 PUBLICATIONS:

Any and all publications relating to the Work and authored by Contractor or any of its subcontractors shall be submitted to the District for its prior written approval of the content of the publication. If the District disapproves of the content of the publication, the author shall withdraw it from publication. The term "publication" as used herein shall include articles or letters to be published in any newspaper, magazine, trade journal or other periodical.

8.02 CONFIDENTIALITY:

Any and all reports, information, data, statistics, forms, designs, plans, procedures, systems, studies and any other communication form of knowledge given to or prepared or assembled by Contractor under this Contract shall, to the extent authorized and permitted by law, be kept as confidential and not be made available by Contractor to any individual, company or organization without the prior written consent of the District. Notwithstanding the foregoing, Contractor shall not be restricted from releasing information in response to a subpoena, court order, or legal process, but Contractor shall notify the District in writing before responding.

8.03 INDEPENDENT CONTRACTOR:

Contractor, for all purposes arising out of this Contract, is an independent contractor and not an employee of the District. It is expressly understood and agreed that Contractor shall not be entitled to any benefits to which the District's employees are entitled, such as overtime, retirement benefits, worker's compensation, injury leave or other leave benefits.

8.04 CONFLICTS:

Should any conflict arise in the Contract Documents, the order of precedence is as follows:

1. Construction Contract.
2. Special Provisions.
3. General Provisions.
4. Supplemental Specifications.
5. Detailed Plans (Calculated dimensions will govern over scaled dimensions).

SPECIAL PROVISIONS

1. General.

A. All labor, services, material, and other work necessary for the construction of the Superior's Rock Creek WWTF Anaerobic Zones Expansion Project shall be provided by Contractor. Contractor's responsibilities shall include, but not be limited to: managing the budget; scheduling and coordinating work meetings; conducting field tests and geotechnical studies; preparing exhibits and participating in formal and informal public meetings at locations provided by the District; and timely processing field orders, change orders and notices of substantial completion.

B. Contractor shall carefully examine all Work, and shall be solely responsible for the character, quality, and quantities of Work, materials, and compliance with the Contract Documents.

C. Contractor shall identify any and all necessary easements for construction and maintenance of the Work.

2. Other Regulations.

A. Contractor shall ensure that the Work is in compliance with the Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual, CDOT Specifications, AASHTO Specifications, International Building Code, Uniform Plumbing Code, Uniform Mechanical Code, National Electrical Code, Americans with Disabilities Act, and other applicable codes and specifications.

B. In case of any discrepancy between any of the requirements set forth in the Urban Drainage and Flood Control District Urban Storm Drainage Criteria Manual, CDOT Specifications, AASHTO Specifications, International Building Code, Uniform Plumbing Code, Uniform Mechanical Code, National Electrical Code, Americans with Disabilities Act, and these Contract Documents, the more stringent requirement shall apply. If any questions arise as to which requirement is more stringent than another, the Project Manager shall be authorized to determine which is more stringent, and the Project Manager's decision shall be final.

3. Representatives. Contractor shall have at the work site at all times as its agent, a competent superintendent capable of reading and thoroughly understanding the Contract Documents and being thoroughly experienced in the type of work being performed. The District shall have a representative on the job site to observe work for conformance with the Contract Documents.

4. Work Administration. The District shall administer the Work, including the finalization of any change orders, pay estimates and payments of such, acceptance of work, and other matters as stipulated in the Contract Documents.

5. Engineer. The Engineer for this Work shall Dewberry Engineers, Inc.

6. Inspections and Testing.

A. Contractor shall be responsible for performing materials testing. In addition to the materials testing performed by Contractor, the District may conduct Quality Assurance testing at its own discretion.

B. Contractor shall coordinate its construction schedule with the testing agency and District so that key inspection points may be observed. If Contractor fails to provide reasonably adequate notice or proceeds without the required inspection, the subject work shall be re-exposed or redone in its entirety, while the inspector is present. No extra compensation shall be awarded to Contractor for extra work due to Contractor's failure to coordinate inspections with the testing agency or the District. All costs associated with Contractor's failure to coordinate inspections shall be borne by Contractor.

C. Contractor shall perform construction inspections. Contractor shall attend any pre-construction meeting(s) and be available to provide technical assistance during the course of construction as necessary. Contractor shall provide site visits and reviews upon request from the District during the construction phase to ensure compliance with the intent of the plans and to resolve any potential conflicts. Contractor shall provide a written summary after each site visit.

D. Contractor shall be responsible for scheduling the final inspection with the District.

7. Construction Schedule.

A. At the time of the Pre-construction Conference, Contractor shall prepare and submit to the District for review a construction schedule including: proposed daily construction hours; details of all construction items; start and finish dates; confirmation and dates for coordinating all utility relocation and/or interruptions; and the same information for all subcontractor(s). The schedule shall not be changed without prior notification and review by the District. The schedule shall be in the form of a chart of suitable scale to indicate approximately the percentage of Work scheduled for completion at any time. Contractor shall enter on the chart the actual progress at the end of each 2-week interval as directed by the District and shall deliver to the District 3 copies thereof on a biweekly basis.

B. Contractor shall also prepare and submit a schedule of the anticipated manpower by title and duty. The manpower proposed shall be adequate for orderly flow of work and completion within the time specified in the Contract Documents.

C. All construction activities shall be coordinated with the Project Manager.

8. Saturday, Sunday, Holiday and Night Work.

A. Work shall normally not be performed on Saturdays, Sundays, observed holidays, or outside of the daytime working hours of 7:00 a.m. to 7:00 p.m., or as indicated on the construction schedule. Lane closures are restricted to 8:30 a.m. to 3:30 p.m. on arterial and collector streets, except for such work as may be necessary for proper care, maintenance, and protection of Work already completed, or in cases where the Work would be endangered or if hazards to life or property would result.

B. If Contractor believes it necessary to work on Saturdays, Sundays, holidays, or at night, Contractor shall make prior arrangements with the District and receive written approval at least 48 hours before such time so that inspection and engineering services can be provided. Such approval may be revoked by the District if Contractor fails to maintain adequate equipment and lighting at night for the proper prosecution, control, and inspection of the work. If Work is performed without the District's prior approval, and as a result the District had not assigned inspectors to the work, the District may declare Work performed during this period of time defective, solely on the grounds that it was not properly inspected.

C. Any Work performed on a Saturday, Sunday, holiday, or night shall be at Contractor's risk in terms of extra costs, extra work, or unforeseen conditions.

9. Progress Reports.

A. Progress reports and progress/manpower schedules shall be updated and submitted to the Project Manager at the end of each 2-week period, or at such other times as the Project Manager may request. Contractor shall also forward to the Project Manager, at the end of each month, an itemized report of the delivery status of major and critical items of purchased equipment and material, including shop drawings and the status of shop and field fabricated work.

B. If the completion of any part of the Work or the delivery of materials is behind the approved schedule, Contractor shall submit a plan acceptable to the Project Manager for bringing the Work up to schedule. The District shall have the right to withhold progress payments for the work if Contractor fails to update and submit the progress/manpower schedule and reports as specified.

10. Pre-construction Conference.

A. Contractor shall coordinate the Pre-construction Conference. Contractor's designated supervisor(s) assigned to the Work shall attend this meeting.

B. Prior to mobilizing construction equipment, a Pre-construction Conference will be held. Contractor's designated superintendent(s) or supervisor(s) assigned to the Work shall attend this meeting. Contractor shall, at a minimum, provide the following to the District at the Pre-construction Conference:

- (1) The construction schedules;
- (2) A detailed estimate of partial payments for the Work;
- (3) The traffic control plan;
- (4) A detailed plan showing site access and staging areas; and
- (5) A subcontractor submittal, including names and contact phone numbers.

11. Fees and Permits.

A. Prior to commencing any Work, Contractor shall secure, at its own expense, all necessary fees and permits required for the performance of the Work, including an Army Corps of Engineers 404 permit, if necessary. The cost of compliance with this Section (including fees) is included in the Contract Price, and no additional compensation shall be provided.

B. All fees for permits issued by the District shall be waived.

12. Existing Utilities.

A. The Work shall be coordinated with all impacted utility companies, districts, associations, agencies, and residents located in the work site. Contractor shall conduct the meeting and provide summary minutes.

B. Contractor shall determine the actual location of all existing utilities prior to starting any Work. Contractor shall contact utility companies for field locations prior to the start of Construction Work, and shall contact all utilities at least 48 hours prior to beginning

excavation and/or grading. If the exact location and depth of existing underground utilities are unknown, Contractor shall perform all necessary exploratory excavation to locate these facilities which may affect the Work prior to beginning construction. Contractor shall obtain required locates and Contractor shall include the information on the plans. Contractor shall resolve any utility discrepancies. Contractor shall be liable for all damage done to existing utilities in the performance of the Work.

C. If Contractor requests that utility companies relocate utilities for Contractor's convenience, such relocation shall be at Contractor's expense.

D. The time of performance under the Contract shall not be extended to account for repair of utilities which are damaged by Contractor.

13. Water and Electricity. Contractor shall provide and maintain, at its own expense, an adequate supply of water and electricity required for the Work. Contractor shall install and maintain supply connections and lines satisfactory to the Project Manager, and prior to Final Completion, Contractor shall remove the supply lines at its expense.

14. Dust Control. Contractor shall use measures to prevent and control dust within the area affected by the Work. No additional compensation shall be paid to Contractor for dust control. Contractor shall clean any soil, dirt, or debris tracked onto any adjacent streets. Within 24 hours of notification by the District that any adjacent streets require cleaning, Contractor shall clean such streets or the District may have the streets cleaned and deduct the cost of such cleaning from the Contract Price.

15. Construction Staging Areas. All construction staging areas shall be located within the work site. The boundaries of construction staging areas shall be approved by the District. Construction staging areas shall be used for material storage, parking for equipment, and employees' vehicles. A construction trailer shall not be required, but may be used if the location of the trailer is approved by the District. Upon Final Completion, all staging areas shall be clean and restored to their original condition. No additional compensation shall be provided to Contractor for cleaning of construction staging areas.

16. Sanitary Facilities.

A. Sanitary convenience for the use of all persons employed on the work, properly screened from public observation, shall be provided in sufficient numbers and in such a manner and at such points as approved by the District. The contents shall be removed and disposed of in a satisfactory manner.

B. The sanitary conveniences specified above shall be the obligation and responsibility of Contractor. The facilities shall be made available to all other contractors, subcontractors, and inspection personnel in the work site.

C. Contractor shall supply sufficient drinking water from approved sources to all of its employees.

D. Full compensation for compliance with this Section is included in the Contract Price, and no additional compensation shall be provided.

17. Soils Investigations and Foundation Engineering. Contractor shall be responsible for all geotechnical investigations necessary to design and perform the Work.

18. Lines and Grades. Contractor shall lay out the Work and shall be responsible for all measurements in connection therewith. Contractor shall, at its own expense, furnish all stakes, templates, platforms, equipment, and labor, including surveyors, that may be required in setting and cutting or laying out any part of the Work. Contractor shall be responsible for the proper execution of the Work to such lines and grades.
19. Traffic Control.
- A. Contractor shall furnish all necessary flagpersons; erect and maintain warning lights, advance warning signs, detour signs, barricades, temporary fence, and sufficient safeguards around all excavations, embankments, obstructions; and perform any other work necessary for the protection of all work being performed, and for the safety of the public and pedestrian traffic, as well as motor vehicles. All signs and barricades shall conform to the current Manual on Uniform Traffic Control Devices.
- B. At the Pre-construction Conference, Contractor shall submit 5 copies of a traffic control plan for review by the District. The plan shall discuss the traffic control measures proposed for the safety of vehicular and pedestrian traffic through the work site.
- C. Contractor shall at all times take proper precautions for the protection of and replacement or restoration of landscaping, driveway culverts, street intersection culverts or aprons, irrigation crossings and systems, mailboxes, driveway approaches, signs, existing utilities, and all other public and private installations that may be encountered during the Work.
- D. No driveway or private alley shall be blocked without prior written permission from the resident who would be affected by such blocking, with a copy to the District.
- E. No road shall be closed at any time.
- F. Contractor shall advise the Police Department, school districts, trash services, and homeowners of any lane closures, including dates and times.
- G. It is anticipated that a large number of employees will use automobiles for transportation to and from the work site. It shall be Contractor's responsibility to: maintain, protect, and control traffic in the vicinity of and in the work site; restrict parking on streets near the work site; and provide necessary parking areas for all employees in suitable locations as approved by the District.
20. Archaeological and Historical Discoveries.
- A. Contractor shall inform the District of any evidence which might suggest to a layperson that archaeological or historical materials may be present in the work site. Upon making such a discovery, Contractor shall do whatever is necessary to avoid disturbing the work site. This may require that Contractor's activities be redirected or stopped until the District determines how to proceed.
- B. As a result of Contractor's efforts to preserve the potential discovery at the work site, if Contractor's activities are delayed for longer than 8 normal work hours, Contractor shall prepare accounting information to support an adjustment to the Contract Price.
21. Water Control.
- A. Contractor shall take such precautions as necessary to construct the Work in a dry condition, and Contractor shall provide for drainage, dewatering, and control of all surface

and subsurface water and shall erect any necessary temporary structures or other facilities at its own expense.

B. Contractor, at its own expense, shall furnish all necessary equipment and materials required to control the surface and subsurface water in all the areas from the commencement of Work through Final Completion.

C. Contractor shall be responsible for furnishing, transporting, and installing all materials and equipment, well points, pumping, channelization, diversion, damming, or other means of controlling surface water and ground waters.

22. Disposal Site

A. Contractor shall be responsible for the removal of all excess excavation, debris, deleterious material, muck, asphalt, concrete, trees, stumps, remains from clearing and grubbing, and all other materials not used for the construction of the improvements. Costs of disposal are included in the Contract Price and shall not entitle Contractor to additional compensation. Contractor shall designate in writing a disposal site located outside the District limits and acceptable to the District.

B. Contractor's cost for loading, hauling, daily cleaning of streets, disposal of the earthwork (excavation) materials, together with the construction, maintaining and watering of haul roads, and dump fees and permits are included in the Contract Price and shall not entitle Contractor to additional compensation.

23. Video Prior to Construction. Contractor shall provide the District with a video of the entire work site prior to beginning construction, including all adjacent areas, at Contractor's own expense. One copy of the video shall be provided to the District and become the property of the District prior to the commencement of any Work.

24. Existing Improvements and Restoration.

A. Contractor has field inspected the work site and fully understands that existing landscaping and improvements are present within the work site. Such existing improvements shall be protected. Any damage or disruption in the public right-of-way, drainage easements, District property, or private property related to the Work shall be restored to pre-existing or better condition.

B. Contractor shall be responsible for replacing all existing improvements, including irrigation systems and landscaping, damaged during Contractor's activities, except as otherwise provided in the Contract Documents.

25. Erosion Control. Contractor shall provide an erosion/sediment control plan for use during construction. The plan shall include site specific details showing the type, location, and quantity of BMP's to be used. The erosion/sediment control plan shall be designed to prevent sediment from leaving the construction area. Special attention shall be given to prevent sediment from entering into any wetland area. .

26. Vandalism. Contractor shall take all necessary steps to protect the work site from vandalism. Contractor shall be solely responsible to repair any damage caused by vandalism, including the removal of graffiti, at Contractor's own cost. The Contract Price shall not be increased to reimburse Contractor for such costs.

TECHNICAL SPECIFICATIONS

See attached Technical Specifications

CONSTRUCTION DRAWINGS

See attached Construction Drawings

"General Decision Number: C020240002 08/02/2024

Superseded General Decision Number: C020230002

State: Colorado

Construction Type: Heavy

Counties: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, El Paso, Jefferson, Larimer, Mesa, Pueblo and Weld Counties in Colorado.

HEAVY CONSTRUCTION PROJECTS

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022:	<ul style="list-style-type: none"> . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least \$17.20 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in 2024.
If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022:	<ul style="list-style-type: none"> . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least \$12.90 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2024.

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at <http://www.dol.gov/whd/govcontracts>.

Modification Number	Publication Date
0	01/05/2024
1	02/23/2024
2	07/05/2024
3	07/19/2024
4	08/02/2024

ASBE0028-001 07/01/2024

Rates Fringes

Asbestos Workers/Insulator
(Includes application of all insulating materials, protective coverings,

coatings and finishings to
all types of mechanical
systems).....\$ 34.98 16.47

BRCO007-004 01/01/2024

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS,
JEFFERSON AND WELD COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 42.37	12.86

BRCO007-006 05/01/2024

EL PASO AND PUEBLO COUNTIES

	Rates	Fringes
BRICKLAYER.....	\$ 32.93	14.29

ELEC0012-011 06/01/2024

PUEBLO COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 31.65	15.45

ELEC0068-001 06/01/2024

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS,
JEFFERSON, LARIMER, AND WELD COUNTIES

	Rates	Fringes
ELECTRICIAN.....	\$ 44.95	19.08

ELEC0111-001 09/01/2023

	Rates	Fringes
Line Construction:		
Groundman.....	\$ 24.61	21.25%+7.40
Line Equipment Operator.....	\$ 39.77	21.25%+7.40
Lineman and Welder.....	\$ 55.22	24.25%+7.40

ELEC0111-007 01/01/2024

MESA COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 35.20	13.86

ELEC0113-002 06/01/2024

EL PASO COUNTY

	Rates	Fringes
ELECTRICIAN.....	\$ 38.20	18.10

* ENGI0009-001 05/01/2024

	Rates	Fringes
Power equipment operators:		
Blade: Finish.....	\$ 34.58	15.20
Blade: Rough.....	\$ 34.05	15.20
Bulldozer.....	\$ 34.05	15.20
Cranes: 50 tons and under..	\$ 34.77	15.20
Cranes: 51 to 90 tons.....	\$ 35.07	15.20
Cranes: 91 to 140 tons.....	\$ 36.27	15.20
Cranes: 141 tons and over...	\$ 38.63	15.20
Forklift.....	\$ 34.58	15.20

Mechanic.....	\$ 35.58	15.20
Oiler.....	\$ 34.14	15.20
Scraper: Single bowl under 40 cubic yards.....	\$ 35.20	15.20
Scraper: Single bowl, including pups 40 cubic yards and over and tandem bowls.....	\$ 35.41	15.20
Trackhoe.....	\$ 35.20	15.20

IRON0024-003 11/01/2023

	Rates	Fringes
IRONWORKER, STRUCTURAL.....	\$ 37.23	22.84
Structural		

LAB00086-001 05/01/2009

	Rates	Fringes
Laborers:		
Pipelayer.....	\$ 18.68	6.78

PLUM0003-005 06/01/2024

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS,
JEFFERSON, LARIMER AND WELD COUNTIES

	Rates	Fringes
PLUMBER.....	\$ 50.68	20.15

PLUM0058-002 07/01/2024

EL PASO COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 45.90	17.17

PLUM0058-008 07/01/2024

PUEBLO COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 45.90	17.17

PLUM0145-002 07/01/2023

MESA COUNTY

	Rates	Fringes
Plumbers and Pipefitters.....	\$ 37.57	14.93

PLUM0208-004 06/01/2024

ADAMS, ARAPAHOE, BOULDER, BROOMFIELD, DENVER, DOUGLAS,
JEFFERSON, LARIMER AND WELD COUNTIES

	Rates	Fringes
PIPEFITTER.....	\$ 46.01	20.84

SHEE0009-002 07/01/2024

	Rates	Fringes
Sheet metal worker.....	\$ 39.47	21.83

* TEAM0455-002 05/01/2024

	Rates	Fringes
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Truck drivers:
 Pickup.....\$ 26.21 4.82
 Tandem/Semi and Water.....\$ 26.84 4.82

 * SUC02001-006 12/20/2001

	Rates	Fringes
BOILERMAKER.....	\$ 17.60	
Carpenters:		
Form Building and Setting...	\$ 16.97 **	2.74
All Other Work.....	\$ 15.14 **	3.37
Cement Mason/Concrete Finisher...	\$ 17.31	2.85
IRONWORKER, REINFORCING.....	\$ 18.83	3.90
Laborers:		
Common.....	\$ 11.22 **	2.92
Flagger.....	\$ 8.91 **	3.80
Landscape.....	\$ 12.56 **	3.21
Painters:		
Brush, Roller & Spray.....	\$ 15.81 **	3.26
Power equipment operators:		
Backhoe.....	\$ 16.36 **	2.48
Front End Loader.....	\$ 17.24	3.23
Skid Loader.....	\$ 15.37 **	4.41

 WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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 ** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 (\$17.20) or 13658 (\$12.90). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at <https://www.dol.gov/agencies/whd/government-contracts>.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

 The body of each wage determination lists the classification and wage rates that have been found to be prevailing for the cited type(s) of construction in the area covered by the wage determination. The classifications are listed in alphabetical

order of ""identifiers"" that indicate whether the particular rate is a union rate (current union negotiated rate for local), a survey rate (weighted average rate) or a union average rate (weighted union average rate).

Union Rate Identifiers

A four letter classification abbreviation identifier enclosed in dotted lines beginning with characters other than ""SU"" or ""UAVG"" denotes that the union classification and rate were prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2014. PLUM is an abbreviation identifier of the union which prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in processing the wage determination. 07/01/2014 is the effective date of the most current negotiated rate, which in this example is July 1, 2014.

Union prevailing wage rates are updated to reflect all rate changes in the collective bargaining agreement (CBA) governing this classification and rate.

Survey Rate Identifiers

Classifications listed under the ""SU"" identifier indicate that no one rate prevailed for this classification in the survey and the published rate is derived by computing a weighted average rate based on all the rates reported in the survey for that classification. As this weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SULA2012-007 5/13/2014. SU indicates the rates are survey rates based on a weighted average calculation of rates and are not majority rates. LA indicates the State of Louisiana. 2012 is the year of survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 5/13/2014 indicates the survey completion date for the classifications and rates under that identifier.

Survey wage rates are not updated and remain in effect until a new survey is conducted.

Union Average Rate Identifiers

Classification(s) listed under the UAVG identifier indicate that no single majority rate prevailed for those classifications; however, 100% of the data reported for the classifications was union data. EXAMPLE: UAVG-OH-0010 08/29/2014. UAVG indicates that the rate is a weighted union average rate. OH indicates the state. The next number, 0010 in the example, is an internal number used in producing the wage determination. 08/29/2014 indicates the survey completion date for the classifications and rates under that identifier.

A UAVG rate will be updated once a year, usually in January of each year, to reflect a weighted average of the current negotiated/CBA rate of the union locals from which the rate is based.

State Adopted Rate Identifiers

Classifications listed under the ""SA"" identifier indicate that the prevailing wage rate set by a state (or local) government was adopted under 29 C.F.R §1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. 01/03/2024 reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

WAGE DETERMINATION APPEALS PROCESS

1.) Has there been an initial decision in the matter? This can be:

- * an existing published wage determination
- * a survey underlying a wage determination
- * a Wage and Hour Division letter setting forth a position on a wage determination matter
- * a conformance (additional classification and rate) ruling

On survey related matters, initial contact, including requests for summaries of surveys, should be with the Wage and Hour National Office because National Office has responsibility for the Davis-Bacon survey program. If the response from this initial contact is not satisfactory, then the process described in 2.) and 3.) should be followed.

With regard to any other matter not yet ripe for the formal process described here, initial contact should be with the Branch of Construction Wage Determinations. Write to:

Branch of Construction Wage Determinations
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2.) If the answer to the question in 1.) is yes, then an interested party (those affected by the action) can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Write to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and by any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3.) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

4.) All decisions by the Administrative Review Board are final.

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END OF GENERAL DECISION"

SUPERIOR METROPOLITAN DISTRICT NO. 1

ROCK CREEK WASTEWATER TREATMENT FACILITY ANAEROBIC ZONES EXPANSION

TECHNICAL SPECIFICATIONS

ISSUED FOR BID

SEPTEMBER 2024

SUPERIOR METROPOLITAN DISTRICT NO. 1
2125 HONEY CREEK DRIVE
SUPERIOR, CO 80027



DEWBERRY ENGINEERS INC.
990 S. BROADWAY, SUITE 400
DENVER, CO 80209

**SUPERIOR METROPOLITAN DISTRICT NO. 1
ROCK CREEK WASTEWATER TREATMENT FACILITY
ANAEROBIC ZONES EXPANSION PROJECT**

**DRAFT TECHNICAL SPECIFICATIONS
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**SUPERIOR METROPOLITAN DISTRICT NO. 1
ROCK CREEK WASTEWATER TREATMENT FACILITY
ANAEROBIC ZONES EXPANSION PROJECT**

**DRAFT TECHNICAL SPECIFICATIONS
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SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Summary of Work section herein provides a brief description of the work to be performed by the CONTRACTOR. This summary is not intended to be a complete listing of all work required under this Contract. Complete the work required by the Contract Documents regardless of whether or not the work is specifically listed here.
- B. The work generally consists of the following work items:
- Demolition of existing storage room in existing treatment building
 - Construction of concrete tankage for two (2) anaerobic zones and influent splitter channel.
 - Procurement and installation of associated piping, appurtenances, and supports.
 - Procurement and installation of four (4) slide gates
 - Procurement and installation of four (4) submersible mixers
 - Procurement and installation of associated electrical.

1.02 MAJOR PROJECT COMPONENTS

- A. The anaerobic zones and associated piping, mechanical, and electrical components will be constructed as shown on the drawings.

1.03 CONSTRUCTION STAGING AREA

- A. The OWNER will coordinate with property owners and designate CONTRACTOR's temporary construction staging area. A site visit is required to verify field conditions and the available staging area.

1.04 WORK SEQUENCING

- A. CONTRACTOR shall submit a construction-sequencing schedule to the ENGINEER as required in the General Conditions prior to mobilization. The CONTRACTOR shall coordinate with OWNER and WWTF Operations Staff regarding demolition and pipe relocation to limit disruptions to the existing treatment process. This schedule will depict how the CONTRACTOR will schedule the work to complete the project within the specified time.
- B. The CONTRACTOR shall make its own investigations before beginning any construction, including exploratory excavations and contacting utility owners, to determine the locations and type of existing utilities, including service connections, prior to commencing work which could result in damage to such utilities. The CONTRACTOR shall immediately notify the ENGINEER and OWNER as to any utilities discovered in a different position than indicated in the Contract Documents or which is not indicated in the Contract Documents.

1.05 PERMITS

- A. Contact all Federal, State, and Local agencies to determine permitting requirements for construction related activities under their jurisdiction. CONTRACTOR shall obtain and pay for all permits required for completion of the work. The mention of specific permits in the Contract Documents shall not imply that those are the only permits required, and shall not relieve the CONTRACTOR from obtaining any and all permits required for construction. CONTRACTOR shall coordinate with appropriate permit authorities to arrange for progress inspections of the work, as required.
- B. The CONTRACTOR shall obtain a Building Permit. Contact the Building Department, 122 East Williams Street, Superior, 80027, 303-499-3675, for permitting information.
- C. Copies of all permits shall be provided to OWNER upon receipt.
- D. No work shall be started until all permits are in order unless specially approved otherwise in writing by either OWNER or the permitting agency.
- E. The permits required for this project include, but are not limited to, the following:
 - 1. Building Permit through the Town of Superior Building Department.
 - 2. If the contractor disturbs more than one acre of ground, a stormwater permit will be required.

1.06 SAFETY

- A. The CONTRACTOR shall make special efforts to comply with all safety regulations, laws, and requirements and assure that all workers are properly trained in safety practices. The CONTRACTOR shall allow representatives of OWNER to attend any onsite safety meetings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 11 13

CONTRACT TIME

PART 1 GENERAL

1.01 SCOPE

A. This Section defines completion dates for elements of the Project.

1.02 SPECIFIC DATE SCHEDULE

A. The specific durations listed in the following schedule represent the maximum duration of each project element unless modified by change order or written amendment between the OWNER and CONTRACTOR.

Construction Deadlines	Duration, Days
Construction Documents Available	0
Mandatory Pre-Bid Meeting	8
Questions Deadline	14
Final Addendum	21
Bid Opening	28
Notice of Award	35
Notice to Proceed (anticipated)	36
Substantial Completion	210 days after Notice to Proceed
Final Completion	14 days after Substantial Completion

1.03 SCHEDULE ADJUSTMENTS

A. If the Notice to Proceed is issued to the CONTRACTOR before or after the date listed under paragraph 01 11 13-1.02, each construction deadline specified in the Specific Date Schedule will not be adjusted to maintain the specified duration available to complete the project unless there is a significant difference.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 15 00

OPERATION OF WASTEWATER TREATMENT FACILITY & CONSTRUCTION SEQUENCING

PART 1 GENERAL

1.01 SCOPE

- A. Requirements to maintain operation of existing wastewater treatment facilities, coordination to avoid interference with normal operation of equipment and processes, and penalties for discharge or bypassing untreated water.

1.02 CONTINUOUS OPERATION REQUIRED

A. General

- 1. The existing water treatment plant is currently and continuously receiving and treating influent wastewater. Treatment in the existing wastewater treatment plant shall not be interrupted until new facilities constructed under this contract have been completed and placed in operation.

1.03 RESTRICTIONS ON PROCESS, PIPING, AND EQUIPMENT SHUTDOWNS

A. General

- 1. Modifications to existing structures and connections between new work and existing facilities require certain processes, piping and equipment to be removed from service and will result in disruptions to plant operations. This section sets forth restrictions on the removal or planned shutdowns of pipelines, processes, and equipment or any portion thereof.

B. Plant Shutdowns

- 1. Shutdowns of the entire treatment facility shall not be permitted unless CONTRACTOR can demonstrate to the satisfaction of OWNER that there is no alternative method to accomplish a particular activity.

C. Planned Shutdowns of Pipelines, Processes, and Equipment

- 1. CONTRACTOR shall schedule the work such that only one major plant or process disruption occurs at any given time. CONTRACTOR shall complete all connections to existing process piping in a manner that minimizes the risk of permit violations or process upsets. Planned shutdowns for demolition, removal or connection to existing pipelines, processes, and equipment or any portion thereof shall comply with the following restrictions:
 - a. Written shutdown plan and schedule submitted to OWNER and ENGINEER one week prior to each shutdown
 - b. Written notice to OWNER and ENGINEER 48 hours prior to each shutdown
 - c. Shutdown only between the hours of 7 a.m. and 4:30 p.m. the same day

- d. Shutdown of pipelines, processes, and equipment shall be limited to 8 hours duration

D. Shutdown Plan

1. For operations that require removing a tank, pipeline, channel, electrical circuit, equipment or structure from service, CONTRACTOR shall prepare a detailed shutdown plan and schedule. The detailed plan shall describe CONTRACTOR's method for maintaining operation of existing water treatment processes during each shutdown. Where items are required to be removed from service, the shutdown plan shall detail necessary plant, personnel, and equipment which CONTRACTOR shall provide to maintain operation of existing water treatment processes. The shutdown schedule shall be coordinated with the project construction schedule specified in Section 01 32 00.

E. Temporary Facilities to Maintain Continuous Operation

1. If construction activities cannot be completed within the time limits for planned shutdowns of pipelines, processes, and equipment set forth in this section, CONTRACTOR shall provide such additional temporary plant, piping, equipment and personnel necessary to comply with the requirements of this section. This shall include but not be limited to generators, pumps, electrical switchgear, wiring, piping, piping connections and supports, temporary structures, and manpower for setup, operation and removal of temporary items. Where additional or temporary plant or equipment is to be provided, the CONTRACTOR shall provide information regarding the type, number, size, location, and other pertinent information as requested by the OWNER for review.

F. Potential Construction Sequencing:

1. Demolition of storage room building above grade.
2. Set up and coordination of bypass pumping of influent wastewater.
3. Excavation and demolition of storage room building substructure.
4. Construction of concrete tankage.
5. Installation of piping, mixers, slide gates, associated appurtenances, and electrical.
6. Commissioning of new anaerobic zones.
7. Grading and miscellaneous site work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END SECTION

SECTION 01 29 50

SCHEDULES OF VALUES

PART 1 GENERAL

1.01 SCOPE

- A. Preparation and submission of detailed schedules showing the value assigned to each part of the work and the value of all major equipment. The Schedule of Values and Major Equipment List will be used to determine amount of progress payments due to CONTRACTOR for completed Work and for procurement and delivery of major equipment to the project site.

1.02 SUBMITTAL METHOD

- A. Submit Schedule of Values. Use of CONTRACTOR's typed or computer printout standard forms will be considered upon request.

1.03 SUBMITTAL DEADLINE

- A. Submit the Schedule of Values and Major Equipment List by the following deadlines:
 - 1. Schedule of Values. Submit within 30 days after issuance of the Notice to Proceed and prior to submitting the first application for a progress payment

1.04 ITEMIZED COST BREAKDOWN

- A. Schedules of Values
 - 1. The Schedule of Values shall subdivide the Work into component parts in sufficient detail to permit the ENGINEER to evaluate requests for progress payments. The Schedule of Values shall be listed in tabular form and conform with the following:
 - a. List name of Project, location, Owner, date of submission, and name of Contractor
 - b. List estimated quantities and total estimated costs
 - c. Component parts shall not exceed \$100,000 per item except for documented deliveries of equipment or materials
 - d. List installation labor separate from products
 - e. List spare parts, testing, inspection, training, operation and maintenance manuals, and commissioning expenses separately
 - f. Allocate overhead and profit in an amount proportional to each item
- B. Major Equipment List
 - 1. The Major Equipment List shall provide the costs for major equipment for use by the Engineer to evaluate requests for progress payments. The Major Equipment List shall be listed in tabular form and shall include the following:
 - a. List major equipment by specification section numbers

- b. If two or more items are specified in a section, identify each item separately
- c. List all major equipment with a cost per unit or item greater than \$10,000
- d. List the manufacturer's Invoice price of the major equipment
- e. List installation labor separate from products
- f. List spare parts, testing, inspection, training, operation and maintenance manuals, and commissioning expenses separately
- g. Include the value of auxiliary control devices or instruments in the cost of the major equipment item
- h. Allocate overhead and profit in an amount proportional to each item

C. Balanced Cost Distribution

- 1. CONTRACTOR shall certify that the Schedule of Values and Major Equipment List are balanced and that the value assigned to each part of the work represents his estimate of the actual cost, including overhead and profit, of performing that part of the work. Upon request, submit documentation to support the values assigned to each item. Sum of all values listed in the Schedule of Values and Major Equipment List shall equal the Contract Price.

1.05 APPROVAL BY ENGINEER

- A. The Schedule of Values and Major Equipment List will be reviewed by Engineer. Upon approval by ENGINEER, the Schedule of Values and Major Equipment List shall be the reporting form upon which Application for Payment will be calculated.

1.06 FORM OF APPLICATION FOR PAYMENT

- A. Upon acceptance of the schedule of values by ENGINEER and OWNER, the schedule shall be incorporated into the form for Application for Payment and such form shall be subject to ENGINEER's and OWNER's reasonable approval. The CONTRACTOR shall revise the schedule of values if requested by OWNER. The Application for Payment shall list amount previously billed, amount billed this period, and total amount billed. The Application for Payment may include payment for materials delivered to the construction site. Title to such materials will pass to the OWNER at the time of payment free and clear of all claims, security interests and encumbrances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END SECTION

SECTION 01 31 19
PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

- A. This section includes requirements for all project meetings including the pre-construction conference, progress meetings, and schedules and reports.

1.02 PROJECT MEETINGS

A. Preconstruction Conference

1. OWNER will administer a preconstruction meeting to be attended by OWNER, ENGINEER, CONTRACTOR and his on-site superintendent, Colorado Department of Public Health and Environment representative, and representatives of principal subcontractors and suppliers, if needed. Items to be discussed will include construction schedules, critical work sequencing, project coordination, quality control procedures, field decision procedures, substitutions, submittals, change orders, and applications for payment. Other items to be covered will include procedures for testing, maintaining record documents, construction facilities, temporary utilities, and project security.

B. Progress Meetings

1. Progress meetings shall be conducted as needed or at a frequency commensurate for the project. These meetings shall be attended by the OWNER's Project Manager, ENGINEER, and CONTRACTOR's Project Manager and Superintendent and other construction team members as appropriate such as subcontractor representatives.
2. The meetings will be conducted by the CONTRACTOR. The agenda of these project meetings shall include reports on construction progress, field observations, problems, conflicts, status of submittal reviews, status of information requests, revisions to construction schedule, quality control, and any general business. Minutes will be published DRAFT within one day of meeting. Comment period shall be one week and the accepted as approved final at the next meeting.

1.03 SCHEDULES AND REPORTS

A. Initial Coordination Submittals

1. Within ten days after the Effective Date of the Agreement, CONTRACTOR shall submit the following to OWNER for review and acceptance:
 - a. A preliminary work progress schedule.
 - b. A preliminary schedule of submittals.
 - c. A preliminary schedule of values for the work.

B. Work Progress Schedule

1. The schedule shall show the work in a graphic format suitable for displaying scheduled and actual progress.

- a. Prepare schedules as a horizontal bar chart with separate bar for each major portion of the work.
 - b. The schedule shall also show the work broken down into major phases and key items with the dates work is expected to begin and be completed. Sequencing of listings shall be in the chronological order of the start of each item of work.
2. ENGINEER will review and comment on schedule and, upon agreement with CONTRACTOR on any necessary changes, CONTRACTOR will furnish OWNER and ENGINEER prints of the accepted schedule. CONTRACTOR shall not change the accepted progress schedule without prior concurrence of OWNER.
 3. Submit to OWNER for acceptance of an updated schedule monthly. Schedule shall show actual progress and any proposed changes in the schedule of remaining work.
- C. Work Progress Reports
1. The schedule of work shall be monitored on a weekly basis and updated on a monthly basis. More frequent reports may be required should the work fall behind the accepted schedule.
 2. Work progress reports shall consist of marked copies of prints made from the accepted work progress schedule and a narrative report.
 3. A work progress report shall accompany each application for partial payment. Work reported complete but not readily apparent to OWNER must be substantiated with supporting data.
- D. List of Subcontractors and Major Suppliers
1. CONTRACTOR shall submit to OWNER, at the preconstruction meeting, a list of all subcontractors and major suppliers complete with contact person, address, and telephone number of each.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 00

CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals

1. Preliminary Progress Schedule: Submit at least 7 days prior to preconstruction conference.
2. Detailed Progress Schedule:
 - a. Submit initial Detailed Progress Schedule within 20 days after Effective Date of the Agreement.
 - b. Submit an Updated Progress Schedule at each update, in accordance with Article Detailed Progress Schedule.
 - c. 3-Week Look Ahead Schedule
3. Submit with Each Progress Schedule Submission:
 - a. CONTRACTOR's certification that Progress Schedule submission is actual schedule being utilized for execution of the work.
 - b. Progress Schedule: One legible copy.
4. Prior to final payment, submit a final Updated Progress Schedule.

1.02 PROJECT MILESTONES

A. Include Project Milestones with Progress Schedule specified as follows:

1. Substantial Completion: Work specified in Section 01 11 00, Summary of Work, with the following exceptions:
 - a. If any surface disturbance occurs, revegetation requirements for permanent seeding and mulching in accordance with the Drawings and Town of Superior requirements.
2. Final Completion: Work specified in Section 01 11 00, Summary of Work.

1.03 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 90 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. Major structural, mechanical, and equipment Work.
 10. System startup summary.
 11. Project close-out summary.
 12. Demobilization summary.
- C. Update Preliminary Progress Schedule monthly; as part of progress payment process. Failure to do so may result in 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: Bar Chart.

1.04 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: Bar Chart.
- E. Update monthly to reflect actual progress and occurrences to date, including weather delays.

1.05 PROGRESS SCHEDULE - BAR CHART

- A. General: Comprehensive bar chart schedule, 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. Format
 1. Unless otherwise approved, white paper, 11 inch by 17 inch sheet size.
 2. Title Block: Show name of project and the owner, date submitted, revision or update number, and name of scheduler.

3. Identify horizontally, across the top of the 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. Early start and early finish dates for each activity.
 6. Successor and predecessor activity numbers for each activity.
 7. Legend: Describe standard and special symbols used.
- C. Contents: Identify, in chronological order, those activities reasonably required to complete the Work, including as applicable, but not limited to:
1. Obtaining permits, submittals for early product procurement, and long lead time items.
 2. Mobilization and other preliminary activities.
 3. Initial site work.
 4. Specified work sequences, constraints, and milestones, including Substantial Completion date(s).
 5. Subcontract work.
 6. Major equipment design, fabrication, factory testing, and delivery dates.
 7. Site work.
 8. Cover installation.
 9. Equipment and system startup and test activities.
 10. Project closeout and cleanup.
 11. Demobilization.

1.06 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.
- 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 CONTRACTOR fails to complete activity by its latest scheduled completion date and this failure is anticipated to extend Contract Times (or Milestones), CONTRACTOR shall, within 7 days of such failure, submit a written statement as to how CONTRACTOR intends to correct nonperformance and return 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.

1.07 THREE WEEK LOOK AHEAD

- A. Provide a three (3) week look ahead schedule that includes the week in which the schedule is presented plus the two successive weeks thereafter. Submit no later than 48 hours prior to weekly project progress meeting. Submit at each project progress meeting.

1.08 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. Access restrictions are accurately reflected.
 - d. Startup and testing times are as specified.
 - e. Submittal review times are as specified.
 - 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 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, during which time CONTRACTOR shall update 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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 32 23

SURVEY INFORMATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Provide materials, labor, equipment and incidentals necessary and required to conduct proper surveys to stake and layout work and measure for payment.
- B. Prepare any additional survey using the horizontal control of our survey performed by HORIZONTAL CONTROL OF THIS SURVEY IS BASED ON A MODIFIED NAD 83-COLORADO STATE PLANE NORTH DATUM. VERTICAL CONTROL IS BASED ON NAVD88 DATUM
- C. OWNER will provide electronic AutoCAD files to CONTRACTOR for CONTRACTOR to perform engineering surveys and establish reference points per the General Conditions.

1.02 QUALITY ASSURANCE

- A. Perform survey, layout, and related work by a professional land surveyor licensed in the State of Colorado.

1.03 SUBMITTALS

A. Informational Submittals

- 1. Name, address, telephone number, and qualifications of the surveyor, crew chief, superintendent and other persons who are proposed to perform surveys or survey related duties prior to start of any survey work.
- 2. Equipment to be used for field survey.
- 3. Verification by a Professional Land Surveyor registered in the State of Colorado that the methods and procedures for the surveying conform to the accepted practices and will achieve the required positional accuracies.

B. Action Submittals

- 1. Complete As-built data with final horizontal northing and easting coordinates, elevations, pipeline stationing, and pipeline mark number in ASCII file in CSV format and copy of corresponding field survey book pages. Submit survey data weekly to the ENGINEER.
- 2. Complete As-built data with final horizontal northing and easting coordinates, elevations, pipeline stationing, and pipeline mark number in ASCII file in CSV format and the original field survey book. Submit with Record Documents specified in Section 01 77 00, Contract Closeout.

1.04 PROJECT RECORD DOCUMENTS

- A. Maintain onsite a complete, accurate log of control of survey work as it progresses.
- B. Record in field books, original field notes, computations, and other records for the purpose of layout and quantity surveys. Field notes must be neat and legible, complete, self-explanatory, and self-checking. Include, but not limited to, the following in the field notes:

1. Complete index
2. Date of field work
3. Names of crew members
4. Description of controlling survey stations
5. Recovery descriptions of control points and temporary bench marks
6. Sketches of work where applicable
7. As-built information as specified
8. Electronic data collected and reported ASCII file in CSV format

PART 2 PRODUCTS

2.01 GENERAL

- A. Unless otherwise specified in individual specification sections, the following minimum standards apply:
1. Control Surveys: Vertical shall close within 0.03 foot. Horizontal control angles shall close to the nearest 20 seconds plus or minus 10 seconds. Measured distances shall be plus or minus 0.01 feet.
 2. Measurement Surveys: Elevation shall be to the nearest 0.1 feet plus or minus 0.05 feet. Horizontal distances shall be plus or minus 0.1 feet.

2.02 EQUIPMENT AND MATERIALS

- A. Provide equipment and material as required to properly perform the surveys, including, but not limited to, instruments, tapes, rods, measure, mounts and tripods, stakes and hubs, nails, ribbons, and other reference markers. Provide materials that are in good professional quality and in first-class condition.
- B. Calibrate and maintain lasers, transits, and other instruments throughout the execution of the work.

PART 3 EXECUTION

3.01 GENERAL

- A. Exercise care during the execution of the work to minimize any disturbance to existing property surrounding the work area.

3.02 INSPECTION

- A. Verify with ENGINEER the location of control points prior to starting work. Promptly notify ENGINEER of any discrepancies discovered. Verify layouts periodically and when directed by ENGINEER during construction.

3.03 SURVEY CONTROL

- A. Retain professional land surveyor licensed in the State of Colorado to perform or supervise engineering surveying necessary for construction staking and layout.
- B. Location and elevation of Project survey control are shown on Drawings.
- C. Provide survey required to layout the work and as specified.
- D. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
- E. In event of discrepancy in data provided on Drawings, request clarification before proceeding with work.
- F. Maintain complete accurate log of survey work as it progresses.
- G. Protect survey control/monuments prior to starting work and preserve the survey control/monuments during construction. Do not relocate survey control/monuments.
- H. Promptly report to ENGINEER the loss, damage, or destruction of any control point or relocation required because of change in grades or other reasons. Replace dislocated survey control/monuments based on original survey control.

3.04 SURVEY FOR PIPELINE ALIGNMENT AND GRADE

- A. In accordance with applicable specifications.

3.05 AS-BUILT SURVEY REQUIREMENTS

- A. Commence survey from survey control/monuments as published in the Construction Documents.
- B. Survey Northing and Easting.
- C. Survey
 - 1. Clarifier effluent weir.
 - 2. Finished floor and top of wall of new structures.
 - 3. Invert and rim of new manhole and influent wastewater pipe.
 - 4. Invert of new RAS pipes.
 - 5. Top center of appurtenances where applicable.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Supplemental Transmittal Forms
 - 1. Operations and Maintenance Manual Transmittal Form
 - 2. Equipment Record Form
 - 3. Manufacturer's Installation Certification Form
 - 4. Manufacturer's Instruction Certification Form

1.02 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires ENGINEER's responsive action.
- B. Informational Submittals: Written information that does not require ENGINEER's responsive action. Submittals may be rejected for not complying with requirements.

1.03 SUBMITTAL PROCEDURES

- A. Forms: The preferred forms for submittals are as developed by the ENGINEER. Obtain consent of the ENGINEER prior to using other forms.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. ENGINEER reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Submittals Schedule: Comply with requirements in Section 01 32 00, Construction Progress Documentation, for list of submittals and time requirements for scheduled performance of construction activities.
- D. Within 7 days after the date of commencement as stated in the Notice to Proceed, submit the following items for review:
 - 1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or Approved Equivalent") submittals as required in the Contract Documents.

- E. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review commences on ENGINEER's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the work to permit processing, including resubmittals.
1. Initial Review: Allow 15 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. ENGINEER will advise when a submittal being processed must be delayed for coordination. It is considered reasonable that a complete and acceptable submittal is made to the ENGINEER by the first resubmittal on an item. OWNER reserves the right to withhold monies to cover additional costs of the ENGINEER's review beyond the first resubmittal. The ENGINEER's maximum review period for each submittal or resubmittal will be 15 working days.
 2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
 3. Resubmittal Review: Allow 15 working days for review of each resubmittal.
- F. Identification: Place a permanent label or title block on each submittal for identification.
1. Indicate name of firm or entity that prepared each submittal on label or title block.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record review and approval markings and action taken by ENGINEER.
 3. Include the following information on label for processing and recording action taken:
 - a. Project name.
 - b. Date.
 - c. Name and address of ENGINEER.
 - d. Name and address of CONTRACTOR.
 - e. Name and address of subcontractor.
 - f. Name and address of supplier.
 - g. Name of manufacturer.
 - h. Submittal number or other unique identifier, including revision identifier.
 - 1) Use the Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01) for the submittal number. Resubmittals include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
 - i. Number and title of appropriate Specification Section.
 - j. Drawing number and detail references, as appropriate.
 - k. Location(s) where product is to be installed, as appropriate.
 - l. Other necessary identification.
- G. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

- H. Additional Copies: Unless additional copies are required for final submittal, and unless ENGINEER observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
1. Additional copies submitted for maintenance manuals will not be marked with action taken and will be returned.
- I. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Include the ENGINEER's standard submittal transmittal form, a reproducible copy of which is available from ENGINEER, with each transmitted submittal. Submittals without the form or where applicable items on the form are not completed will be returned for resubmittal. ENGINEER will discard submittals received from sources other than CONTRACTOR.
1. Organization:
 - a. Use a single submittal transmittal form for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components.
 - b. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification paragraph and subparagraph, Drawing number, detail number, schedule title or room number as applicable.
 - c. Unless indicated otherwise, match terminology and equipment names and numbers used in submittals with those used in the Contract Documents.
 - d. Disorganized submittals will be returned without review.
- J. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked "Reviewed with ENGINEER's action stamp."
- K. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
1. Use for Construction: Use only final submittals with mark indicating "Reviewed with ENGINEER's action stamp" taken by ENGINEER.

1.04 CONTRACTOR'S USE OF ENGINEER'S ELECTRONIC FILES

- A. General: ENGINEER's electronic files will not be provided for use in connection with Project except as shown on Drawings.

PART 2 PRODUCTS

2.01 PRECONSTRUCTION CONFERENCE SUBMITTALS

- A. At the preconstruction conference, submit the following items to ENGINEER for review:

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitute (“Or Approved Equivalent”) submittals listed in the Bid.
2. Obtain a list of permits and licenses, indicating the agency required to grant the permit, the expected date of submittal for the permit, required date for receipt of the permit, and required date for receipt of transferred permits obtained by OWNER.
3. A Preliminary Baseline Schedule in accordance with Specification Section 01 32 00, Construction Progress Documentation.
4. The preliminary site specific safety plan.

2.02 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer’s written recommendations.
 - b. Manufacturer’s product specifications.
 - c. Manufacturer’s installation instructions.
 - d. Manufacturer’s catalog cuts.
 - e. Wiring diagrams showing factory-installed wiring.
 - f. Printed performance curves.
 - g. Operational range diagrams.
 - h. Compliance with specified referenced standards.
 - i. Testing by recognized testing agency.
 4. Number of Copies: Submit five copies of Product Data, unless otherwise indicated. Provide one additional copy for submittals requiring review by a consultant. ENGINEER will return two (2) copies. Mark up and retain one returned copy as a Project Record Document.
- C. Shop Drawings: Wherever called for in the Contract Documents or where required by the ENGINEER, furnish a Shop Drawing submittal. Shop Drawings may include detail design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. Include the signature and seal of an engineer registered in the appropriate branch in the State of Colorado, unless otherwise indicated, whenever design calculations are required to be submitted as part of a submittal. Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

- a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Roughing-in and setting diagrams.
 - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - f. Shop work manufacturing instructions.
 - g. Templates and patterns.
 - h. Schedules.
 - i. Notation of coordination requirements.
 - j. Notation of dimensions established by field measurement.
 - k. Relationship to adjoining construction clearly indicated.
 - l. Seal and signature of professional engineer if specified.
 - m. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
- 2. Transmittal Form: Include the ENGINEER's standard submittal transmittal form, a reproducible copy of which is available from the ENGINEER, with Shop Drawing submittals. A submittal without the form or where applicable items on the form are not completed will be returned for resubmittal.
 - 3. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8½ by 11 inches but no larger than 36 by 48 inches.
 - 4. Number of Copies: Submit one electronic copy ("PDF" format) of each submittal. ENGINEER will return a transcribed copy in non-editable electronic format.
 - 5. Collate and bind: Number every page in a submittal in sequence. Collate and staple or bound, as appropriate each copy of a submittal. The ENGINEER will not collate sheets or copies.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:
 - a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit four full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. ENGINEER will return one submittal with options selected.
 5. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit four sets of Samples. ENGINEER will retain three Sample sets; one Sample set will be returned.
- E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the work and their intended location.
1. Number of Copies: Submit one electronic copy ("PDF" format). ENGINEER will return one copy.
 - a. Submittals Schedule: Comply with requirements specified in Specification Section 01 32 00, Construction Progress Documentation.
 - b. Application for Payment: Comply with OWNER requirements.
 - c. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the work, including those who are to furnish products or equipment fabricated to a special design.
 2. Number of Copies: Submit four copies of subcontractor list, unless otherwise indicated. ENGINEER will return one copy.

2.03 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
1. Number of Copies: One electronic copy ("PDF" format). ENGINEER will not return copies.
 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Include the signature of an officer or other individual authorized to sign documents on behalf of that entity for certificates and certifications.
 3. Test and Inspection Reports: Comply with requirements specified in Specification Section 01 45 16.13, Contractor Quality Control.

- B. CONTRACTOR's Construction Schedule: Comply with requirements specified in Specification Section 01 32 00, Construction Progress Documentation.
- C. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of engineers, architects, and owners, and other information specified.
- D. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- E. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- F. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- G. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- H. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- I. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- J. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- K. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- L. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- M. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- N. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

- O. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Specification Section 01 77 00, Contract Closeout.
- P. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, used for calculations. Include page numbers.
- Q. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer.
- R. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Statement on condition of substrates and their acceptability for installation of product.
 - 2. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.

PART 3 EXECUTION

3.01 RECORD DRAWINGS

- A. Maintain one full sized set of Drawings at the Site for the preparation of record drawings. On these, mark every project condition, location, configuration, and other change or deviation which may differ from the Contract Drawings at the time of award, including buried or concealed construction and utility features that are revealed during the course of construction. Give special attention to recording the horizontal and vertical location of buried utilities that differ from the locations indicated, or that were not indicated on the Contract Drawings. Supplement record drawings by detailed sketches as necessary or as directed, to fully indicate the work as actually constructed. These record drawings represent as-built conditions, including revisions made by addenda and change orders, and maintained up-to-date during the progress of the work. Use red ink for alterations and notes. Notes identify relevant Change Orders by number and date.
- B. Paper copies of the record drawings may be required by the ENGINEER by the 25th day of every month in conjunction with the monthly pay application as well as at completion of Work. Failure to submit complete requested record drawings may result in payment application being rejected for approval as described in Article 7 of the agreement.
- C. Provide ENGINEER with access to record drawings during the construction period.

3.02 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to ENGINEER.

- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of CONTRACTOR's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.03 ENGINEER'S ACTION

- A. General: ENGINEER will not receive submittals that do not bear CONTRACTOR's approval stamp and will return them without action.
- B. Action Submittals: ENGINEER will receive each submittal and forward to appropriate entity to make marks to indicate corrections or modifications required, and return it. ENGINEER will stamp each submittal when received. Reviewing entity will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 - 1. NO EXCEPTIONS TAKEN: If a submittal is returned marked "NO EXCEPTIONS TAKEN," formal revision and resubmission will not be required.
 - 2. MAKE CORRECTIONS NOTED: If a submittal is returned marked "MAKE CORRECTIONS NOTED," make the corrections on the submittal, but formal revision and resubmission will not be required.
 - 3. AMEND AND RESUBMIT: If a submittal is returned marked "AMEND AND RESUBMIT," revise it and resubmit the required number of copies. Resubmittal of portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as "AMEND AND RESUBMIT," the submittal as a whole is deemed "AMEND AND RESUBMIT" and all 10 drawings are required to be resubmitted.
 - 4. REJECTED – SEE REMARKS: If a submittal is returned marked "REJECTED – SEE REMARKS," means either that the proposed material or product does not satisfy the specification, the submittal is so incomplete that it cannot be reviewed, or is a substitution request not submitted in accordance with the Contract Documents. Prepare a new submittal that is in conformance with the Contract Documents and submit the required number of copies for review.
- C. Fabrication of an item may commence only after the ENGINEER has returned the pertinent submittals marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED." Corrections indicated on submittals are considered as changes necessary to meet the requirements of the Contract Documents and not as changes to the contract requirements.
- D. Review submittals prior to submission to ENGINEER. Sign and date each submittal as being correct and in strict conformance with the Contract Documents. In the case of Shop Drawings, date and sign each sheet. Note deviations from the Contract Documents on the transmittal sheet. ENGINEER will only receive submittals that have been so verified. Non-verified submittals will be returned without action taken.
- E. Corrections or comments made on CONTRACTOR's Shop Drawings during review do not relieve CONTRACTOR from compliance with Contract Drawings and Specifications. Review is for conformance to the program, design concept and general compliance with the Contract Documents only. CONTRACTOR is responsible for confirming and correlating all dimensions and quantities, fabrication processes and techniques, coordinating the Work of all trades, satisfactory and safe performance of the Work, and the quality, means, and methods of construction.

- F. Informational Submittals: ENGINEER will review each submittal and will not return it, or will return it if it does not comply with requirements. ENGINEER will forward each submittal to appropriate party.
- G. Partial submittals are not acceptable, will be considered non-responsive, and will be returned without review.
- H. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

3.04 SUPPLEMENTAL TRANSMITTAL FORMS

- A. Form 01 33 00-B: Submittal Transmittal
- B. Form 01 33 00-C: Operations and Maintenance Manual Transmittal Form
- C. Form 01 33 00-D: Equipment Record Form
- D. Form 01 33 00-E: Manufacturer's Installation Certification Form
- E. Form 01 33 00-F: Manufacturer's Instruction Certification Form

01 33 00-B SUBMITTAL TRANSMITTAL

Submittal Description: _____

Submittal No.: _____

Bid Package No(s): _____

Spec. Section: _____

Project: SMD1 ROCK CREEK WWTF
ANAEROBIC ZONES EXPANSION
PROJECT

Routing	Date Sent	Date Received
Contractor / Field Eng		
Field Eng / Engineer		
Engineer / Field Eng		
Field Eng / Contractor		

Contractor: _____

Engineer: Dewberry Engineers Inc.

Owner: Superior Metropolitan District No. 1

- We are sending you:
- Attached
 - Under separate cover via _____
 - Submittals for review and comment
 - Product data for information only

Remarks: _____

Item No.	Copies	Date	Spec. Section No.	Description	Review action ^a	Reviewer initials	Review comments attached

Notes: ^(a) NET = No exceptions taken; MCN = Make corrections noted; A&R = Amend and resubmit; R = Rejected, Develop Replacement;
 I = Incomplete, not reviewed.
 Attach additional sheets if necessary.

Contractor:

(Certify either A or B)

- A. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work as specified (no exceptions).
- B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

<u>Item No.</u>	<u>Deviation</u>
_____	_____
_____	_____

Certified by: _____

Contractor's Signature

01 33 00-C OPERATION AND MAINTENANCE MANUAL TRANSMITTAL FORM

Date: _____ Submittal No.: _____
 To: _____ Contract No: _____
 _____ Spec. Section: _____
 _____ Submittal Description: _____
 _____ From: _____
 Attention: _____

Checklist	Contractor		Construction Manager	
	Satisfactory	N/A	Accept	Deficient
1. Table of contents				
2. Equipment record forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart				
7. Startup, shutdown, and postshutdown procedures				
8. Normal operations				
9. Emergency operations				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Trouble-shooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance manhours				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				
24. Calibration procedures				

Remarks: _____

 Contractor's Signature

END OF SECTION

SECTION 01 41 26

PROJECT PERMITS

PART 1 GENERAL

1.01 WORK INCLUDES

- A. Project permits
- B. Building permit and all other permits will be acquired by the CONTRACTOR. ENGINEER will submit contract drawings and specifications to building department for review and approval. CONTRACTOR will be responsible for obtaining and maintaining all required project permits. Contact Town of Superior Building Department for confirmation prior to construction.

1.02 SUBMITTALS

- A. State and local permits: At least 30 days prior to the start of construction, provide copies of all necessary state and local permits required to complete the Work in accordance with the provisions of Specification Section 01 33 00.

1.03 PROJECT PERMITS

- A. CONTRACTOR will pay for all fee and permits associated with construction of the project. CONTRACTOR will pay directly to Town of Superior and/or Colorado Department of Public Health and Environment, all fees and charges which are assessed by Town of Superior and CDPHE, which are associated and required to obtain the construction permits that are issued by the Town of Superior and CDPHE, for this Project. The Engineer and Owner will provide all coordination assistance necessary to obtain the Town of Superior and CDPHE permits. Permits include, but not limited to:
 - 1. Building Permit – OWNER/ENGINEER has applied for this permit. CONTRACTOR will complete the process and obtain the issued permit from the Town of Superior.
 - 2. Electrical Permit – OWNER has applied for this permit but CONTRACTOR must complete the process and obtain the issued permit from the Town of Superior.
 - 3. Mechanical Permit – OWNER has applied for this permit but CONTRACTOR must complete the process and obtain the issued permit from Town of Superior.
- B. Obtain all other state and local permits required for the Work.
- C. If the aggregate storage of oil at the Site is over 1,320 gallons or a single container has a capacity in excess of 660 gallons, prepare a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan shall be prepared and certified by an engineering professional registered in the State of Colorado.
- D. All oil storage tanks shall be placed at least 20 feet from streams, flowing or dry watercourses, lakes, wetlands, reservoirs, and any other water source, and the area surrounding the tanks shall be diked to contain more than 1-1/2 times the volume of the largest tank, or more than half the volume of all tanks within the diked area, whichever is greater. Underground storage tanks shall be used only upon submission of a written management plan documenting all necessary regulatory compliance and approval of the OWNER.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 45 16.13

CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 QUALITY CONTROL

- A. Contractors shall submit a quality control plan to ensure cover is installed per the approved submittal.

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 10 days after receipt of Notice to Proceed.
2. CQC Report: Incorporate into construction progress meeting minutes.

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 system for both onsite and offsite work,

and the interrelationship of CONTRACTOR's management and control with OWNER 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 CONTRACTOR.
2. CQC System Manager may perform other duties on the Project.
3. CQC System Manager shall be an experienced construction person, with a minimum of 3 years construction experience on similar type Work.
4. 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.
5. CQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.
6. Identify an alternate for CQC System Manager to serve with full authority during the System Manager's absence. The requirements for the alternate are 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.

- 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 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.
2. 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.
3. Additional Preparatory 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.

3.05 CONTRACTOR QUALITY CONTROL PLAN

A. General

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. Construction will be permitted to begin only after acceptance of the CQC Plan.

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 Paragraph QC 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 also shall be included in the CQC Plan.
 - 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.
 - f. Procedures for tracking preparatory 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, include a CQC report in the construction meeting and minutes. Account for all days throughout the life of the Contract.
- 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.
 - 4. Test and/or control activities performed with results and references to specifications/plan requirements. List deficiencies noted along with corrective action.
 - 5. Material received with statement as to its acceptability and storage.
 - 6. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
 - 7. List instructions given/received and conflicts in Drawings and/or Specifications.
 - 8. 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. 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. 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.
- 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.

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 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

SECTION 01 66 00

SHIPMENT, PROTECTION, AND STORAGE

PART 1 GENERAL

1.01 SCOPE

- A. Equipment, products and materials shall be shipped, handled, stored, and installed in ways which will prevent damage to the items. Damaged items will not be permitted as part of the work except in cases of minor damage that have been satisfactorily repaired and are acceptable to ENGINEER.

1.02 QUALITY ASSURANCE

- A. To the greatest extent possible, CONTRACTOR shall provide products, materials, or equipment of a singular generic kind from a single source.
- B. Where more than one choice is available as options for selection of a product, material, or equipment, CONTRACTOR shall select an option which is comparable with other products, materials, or equipment already selected. Compatibility is a basic general requirement of product/material selections.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Products shall be delivered, handled, and stored in accordance with manufacturer's written recommendations and by methods and means which will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize the long-term storage of products at site and the overcrowding of construction spaces.
- B. CONTRACTOR shall especially provide delivery/installation coordination to ensure minimum holding or storage time for products recognized as flammable, hazardous, fragile, having a short shelf life, or easily damaged due to deterioration, theft, and/or other source of loss.

1.04 EQUIPMENT

- A. All equipment shall be protected against damage from moisture, dust, handling, or other cause during transport from manufacturer's premises to site. Each item or package shall be marked with the number unique to the specification reference covering the item.
- B. Stiffeners shall be used where necessary to maintain shapes and to give rigidity. Parts of equipment shall be delivered in assembled or subassembled units where possible.
- C. Each item of equipment and valve shall have permanently affixed to it a label or tag with its equipment or valve number designated in this contract. Marker shall be of stainless steel or other suitable material to the ENGINEER's approval. Label location will be easily visible.

1.05 SHIPPING

- A. Bearing housings, vents and other types of openings shall be wrapped or otherwise sealed to prevent contamination by grit and dirt.

- B. Damage shall be corrected to conform to the requirements of the contract before the assembly is incorporated into the work. CONTRACTOR shall bear the costs arising out of dismantling, inspection, repair and reassembly.

1.06 FACTORY-APPLIED COATINGS

- A. All coatings on all products and equipment shall be intact and free from blemishes and defects. Any blemished or defective coatings shall be repaired at the sole expense of the CONTRACTOR to ENGINEER's approval and in conformance with the Contract Documents.

1.07 STORAGE

- A. During the interval between the delivery of equipment to the site and installation, all equipment, unless otherwise specified, shall be stored in an enclosed space affording protection from weather, dust and mechanical damage and providing favorable temperature, humidity and ventilation conditions to ensure against equipment deterioration. Manufacturer's recommendations shall be adhered to in addition to these requirements.
- B. Equipment and materials to be located outdoors may be stored outdoors if approved by ENGINEER and if adequately protected against moisture, condensation, sun, temperature, theft, and other outdoor conditions. Equipment shall be stored at least 6 inches above ground. Temporary power shall be provided to energize space heaters or other heat sources for control of moisture condensation. Space heaters or other heat sources shall be energized without disturbing the sealed enclosure.

1.08 PROTECTION OF EQUIPMENT AFTER INSTALLATION

- A. After installation, all equipment shall be protected from damage from, including but not limited to, dust, abrasive particles, debris and dirt generated by the placement, chipping, sandblasting, cutting, finishing and grinding of new or existing concrete, terrazzo and metal; and from the fumes, particulate matter, and splatter from welding, brazing and painting of new or existing piping and equipment. As a minimum, vacuum cleaning, blowers with filters, protective shieldings, and other dust suppression methods will be required at all times to adequately protect all equipment. During concreting, including finishing, all equipment that may be affected by cement dust must be completely covered. During painting operations, all grease fittings and similar openings shall be covered to prevent the entry of paint. Electrical switchgear, unit substation, and motor load centers shall not be installed until after all concrete work and sandblasting in those areas have been completed and accepted and the ventilation systems installed.
- B. PVC piping or materials which are to be submerged shall be installed no earlier than 30 days prior to being placed into service.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 71 13

MOBILIZATION/DEMOBILIZATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Requirements for CONTRACTOR mobilization and demobilization.

1.02 MOBILIZATION

A. Mobilization shall include obtaining necessary permits, moving onto the site all materials and equipment, and furnishing and erecting plants, temporary buildings, and other construction facilities, as required for the completion of the work.

B. Mobilization shall include but not be limited to the following items:

1. Preliminary submittals required in Section 01 33 00 prior to construction for mobilization.
2. Moving on to the site all equipment required.
3. Installing temporary construction utilities and communications devices.
4. Providing temporary field office facilities to the approval of the ENGINEER.
5. Obtaining all required permits.
6. Obtaining all required bonds and insurance.
7. Posting all OSHA required notices and establishment of safety programs.

1.03 DEMOBILIZATION

A. Demobilization includes, but is not limited to, moving all equipment and surplus materials off the site, re-grading and restoring CONTRACTOR's equipment yard(s), final cleanup, and all other project closeout items including all items referenced in Specification Section 01 77 00.

B. All submittals required in the Contract Documents for demobilization.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 77 00
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE

- A. Procedures required for project close out, final cleaning, project record documents, and warranties.

1.02 SUBMITTALS

- A. Project Record Documents as specified in Section 01 78 39.
- B. Product warranties.
- C. Records of the equipment procured and installed.
- D. Records of approvals from the Town of Superior.
- E. Informational Submittals
 - 1. Submit with application for final payment.
 - a. Record Documents: As required in General Conditions.
 - b. Special bonds, Special Guarantees, and Service Agreements.
 - c. Consent of Surety to Final Payment: As required in General Conditions.
 - d. Releases or Waivers of Liens and Claims: As required in General Conditions.
 - e. Releases from Agreements.
 - f. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01 29 00, Measurement and Payment.
 - g. Extra Materials: As required by individual Specification sections.

1.03 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 changes.
 - 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.
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.

1.04 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 OWNER's construction right-of-way or easement.
- 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, OWNER will direct CONTRACTOR to complete the work that may be necessary to satisfy terms of the side agreement or special easement.
 3. If CONTRACTOR refuses 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.
 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 erasable colored pencils (not ink or indelible pencil), clearly describe changes by graphic lines and notes 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 in relation to finished grade 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. Provide reference measurements to at least two 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.
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 CLOSEOUT PROCEDURES

A. Post-construction Repairs

1. Repair any facilities damaged during construction. Repair materials shall match existing facilities in quality, function, and appearance.

B. Final Cleaning

1. 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.
 - a. Leave the work and adjacent areas affected in a cleaned condition satisfactory to ENGINEER.
2. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.
3. Execute final cleaning prior to final project assessment. Vacuum and mop all interior floors. Clean interior and exterior glass, surfaces exposed to view; and woodwork. Remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces, vacuum carpeted and soft surfaces. Clean stationary equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned. Replace filters of operating equipment in any new or modified areas. Clean site, sweep paved areas, and rake clean landscaped surfaces. Remove waste and surplus materials, rubbish, and temporary construction facilities from the site.

END OF SECTION

SECTION 01 78 23

OPERATION AND MAINTENANCE INFORMATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Operation and maintenance (O&M) instructions shall be provided in accordance with this section and as required in the technical sections of this project manual. O&M information shall be provided for each maintainable piece of equipment, equipment assembly or subassembly, and material provided or modified under this contract.
- B. O&M instructions must be submitted and accepted before on-site training may start.

PART 2 PRODUCTS

2.01 TYPES OF INFORMATION REQUIRED

- A. General: O&M information shall contain the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts. In addition, one or more of the following items of information shall be provided as applicable.
- B. Operating Instructions: Specific instructions, procedures, and illustrations shall be provided for the following phases of operations:
 - 1. Safety Precautions: List personnel hazards for equipment and list safety precautions for all operating conditions.
 - 2. Operator Prestart: Provide requirements to set up and prepare each system for use.
 - 3. Startup, Shutdown, And Post-Shutdown Procedures: Provide a control sequence for each of these operations.
 - 4. Normal Operations: Provide control diagrams with data to explain operation and control of systems and specific equipment.
 - 5. Emergency Operations: Provide emergency procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Include emergency shutdown instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance on emergency operations of all utility systems including valve locations and portions of systems controlled.
 - 6. Operator Service Requirements: Provide instructions for services to be performed by the operator such as lubrication, adjustments, and inspection.
 - 7. Environmental Conditions: Provide a list of environmental conditions (temperature, humidity, and other relevant data) which are best suited for each product or piece of equipment and describe conditions under which equipment should not be allowed to run.
- C. Preventive Maintenance: The following information shall be provided for preventive and scheduled maintenance to minimize corrective maintenance and repair:

1. Provide Lubrication Data
 - a. A table showing recommended lubricants for specific temperature ranges and applications
 - b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities
 - c. A lubrication schedule showing service interval frequency
 2. Preventive Maintenance Plan and Schedule: Provide manufacturer's schedule for routine preventive maintenance, inspections, tests, and adjustments required to ensure proper and economical operation and to minimize corrective maintenance and repair. Provide manufacturer's projection of preventive maintenance manhours on a daily, weekly, monthly, and annual basis including craft requirements by type of craft.
- D. Corrective Maintenance: Manufacturer's recommendations shall be provided on procedures and instructions for correcting problems and making repairs.
1. Troubleshooting Guides And Diagnostic Techniques: Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.
 2. Wiring Diagrams And Control Diagrams: Wiring diagrams and control diagrams shall be point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job-specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the terminals for each type identically to actual installation numbering.
 3. Maintenance and Repair Procedures: Provide instructions and list tools required to restore product or equipment to proper condition or operating standards.
 4. Removal and Replacement Instructions: Provide step-by-step procedures and list required tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings, and adjustments required. Instructions shall include a combination of text and illustrations.
 5. Spare Parts and Supply Lists: Provide lists of spare parts and supplies required for maintenance and repair to ensure continued service or operation without unreasonably delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead time to obtain.
 6. Corrective Maintenance Manhours: Provide manufacturer's projection of corrective maintenance manhours including craft requirements by type of craft. Corrective maintenance that requires participation of the equipment manufacturer shall be identified and tabulated separately.
- E. Appendices: The following information shall be provided; include information not specified in the preceding paragraphs but pertinent to the maintenance or operation of the product or equipment.
1. Parts Identification: Provide identification and coverage for all parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and

exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing shall show the index, reference, or key number which will cross-reference the illustrated part to the listed part. Parts shown in the listings shall be grouped by components, assemblies, and subassemblies.

2. Warranty Information: List and explain the various warranties and include the servicing and technical precautions prescribed by the manufacturers or contract documents to keep warranties in force.
3. Personnel Training Requirements: Provide information available from the manufacturers to use in training designated personnel to operate and maintain the equipment and systems properly.
4. Testing Equipment and Special Tool Information: Provide information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components.

PART 3 EXECUTION

3.01 TRANSMITTAL PROCEDURE

- A. Unless otherwise specified, O&M manuals, information, and data shall be transmitted in accordance with Section 01 33 00 accompanied by Transmittal Form 01 33 00-C and Equipment Record Form 01 33 00-D, all as specified in Section 01 33 00. The transmittal form shall be used as a checklist to ensure the manual is complete. Only complete sets of O&M instructions will be reviewed for acceptance.
- B. If manufacturers' standard brochures and manuals are used to describe O&M procedures, such brochures and manuals shall be modified to reflect only the model or series of equipment used on this project. Extraneous material shall be crossed out neatly or otherwise annotated or eliminated.
- C. Electronic copies of the O&M information shall be provided in searchable Adobe Acrobat format (pdf) for review by the ENGINEER. On approval, three (3) hard copies and one electronic copy of the final O&M information shall be provided. For ease of identification, each manufacturer's brochure and manual shall be appropriately labeled with the equipment name and equipment number as it appears in the project manual. The information shall be organized in the binders in numerical order by the equipment numbers assigned in the project manual. The binders shall be provided with a table of contents and tab sheets to permit easy location of desired information.
- D. One (1) electronic copies of the specified O&M information shall be provided.
 1. The O&M manual electronic versions shall include ALL of the information submitted and approved in the individual O&M manuals, and organized in the same order as the information is presented in the hard copy.
 2. All O&M submittals shall be in searchable Adobe Acrobat format (.pdf file extension). All drawings shall be in AutoCAD release 2018 format (.dwg file extension).

3.02 FIELD CHANGES

- A. Following the acceptable installation and operation of an equipment item, the item's instructions and procedures shall be modified and supplemented by the CONTRACTOR to reflect any field changes or information requiring field data.

END OF SECTION

SECTION 01 78 39
RECORD DRAWINGS

PART 1 GENERAL

1.01 SCOPE

- A. Provide ENGINEER with one neatly and legibly marked set of blueline prints of the contract drawings showing the final location of the anaerobic zones, and all related piping, appurtenances, and electrical. Marking of the drawings shall be kept current and shall be done at the time the material and equipment is installed. These drawings shall be available to OWNER and ENGINEER upon request.
- B. Completed record drawings shall be submitted to OWNER prior to and as a condition precedent to final acceptance, or in the case of substantially completed portions of the work, issuance of a partial completion certificate.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 79 00

TRAINING

PART 1 GENERAL

1.01 SCOPE

- A. This Specification section contains requirements for training the Owner's personnel in the proper operation and maintenance of the equipment and systems installed under this Contract.

1.02 QUALITY ASSURANCE

- A. Where specified, provide on-the-job training of Owner's personnel. Training sessions shall be conducted by qualified, experienced, factory-trained representatives of the various equipment manufacturers. Training shall include instruction in both operation and maintenance of the subject equipment.

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with the provisions of Specification Section 01 33 00. The material shall be reviewed and accepted by the Engineer not less than three (3) weeks prior to the provision of training.
 1. Lessons plans for each training session to be conducted by the manufacturer's representatives. In addition, training manuals, handouts, visual aids, and other reference materials shall be included.
 2. Subject of each training session, identity and qualifications of individuals to be conducting the training, and tentative date, time, and duration of each training session.
 3. Following completion of training, submit completed "Manufacturer's Certificate of Instructional Services" included in Part 4 of this Specification section.

PART 2 PRODUCTS

2.01 LESSON PLANS

- A. Formal written lesson plans shall be prepared for each training session. Lesson plans shall contain an outline of the material to be presented along with a description of visual aids to be utilized during the session. Each plan shall contain a time allocation for each subject.
- B. Furnish ten (10) copies of necessary training manuals, handouts, visual aids and reference materials to the Engineer at least one (1) week prior to each scheduled training session.
- C. One complete set of hard-copy originals of the lesson plans, training manuals, handouts, visual aids, and reference material suitably bound for proper organization and easy reproduction shall be delivered to the Engineer to become the property of the Owner to be used for future training. A digital copy of all materials shall also be provided in portable document format (.pdf).
- D. Format and Content
 1. Each training session shall be comprised of time spent both in the classroom and at the specific location of the subject equipment or system.

2. As a minimum, training sessions shall cover the following subjects for each item of equipment or system:
 - a. Familiarization.
 - 1) Review catalog, parts lists, drawings, etc., which have been previously provided for the plant files and in the "Operation and Maintenance Manuals."
 - 2) Present the check-out procedures for the installation of the specific equipment items.
 - 3) Demonstrate each item of equipment and each system.
 - 4) Answer questions.
 - b. Safety.
 - 1) Using material previously provided, review safety references.
 - 2) Discuss proper precautions around equipment.
 - c. Operation.
 - 1) Review reference literature.
 - 2) Explain all modes of equipment and system operation—operator prestart, startup, shutdown, post shutdown, normal operation, and emergency operation.
 - 3) Review all operating parameters for specific equipment/system and any and all interrelated equipment/systems.
 - 4) Review all associated environmental conditions that could affect equipment/ system operation.
 - 5) Check out Owner's personnel on proper use of the equipment.
 - d. Preventive maintenance.
 - 1) Review reference material and provide instruction on preventive maintenance (PM) procedures including daily, weekly, monthly, quarterly, semiannual, annual, and situational jobs.
 - 2) Review craft requirements, tools and special tools, and time required to perform jobs.
 - 3) Show how to perform PM jobs.
 - 4) Show Owner's personnel what to look for as indicators of equipment problems.
 - e. Corrective maintenance.
 - 1) List possible problems.
 - 2) Discuss repairs.
 - 3) Point out special problems.
 - 4) Review needs for various crafts/skills and special tools.
 - 5) Review time requirements.
 - 6) Open up equipment and demonstrate procedures, where practical.

- f. Parts and service.
 - 1) Show how to use previously provided parts lists and procedures for ordering parts.
 - 2) Check over spare parts on hand.
 - 3) Make recommendations regarding additional parts that should be available.
 - 4) Provide name, address, and telephone numbers of local representatives to order parts and to get service and/or emergency help.
- g. "Operation and Maintenance Manuals."
 - 1) Review any other material included in the "O&M Manuals."
 - 2) Update material, as required.

PART 3 EXECUTION

3.01 GENERAL

- A. Where specified, the Contractor shall conduct training sessions for the Owner's personnel to instruct the staff on the proper operation, care, and maintenance of the equipment and systems installed under this Contract.
 - 1. Training shall take place at the Site of the Work and under the conditions specified in the following paragraphs.
 - 2. Provide all audio and/or visual equipment needed to present the required training.
 - 3. The O&M Manuals must be submitted and accepted in accordance with Specification Section 01 78 23 before on-Site training may start.

3.02 SCHEDULE

- A. Training shall be conducted in conjunction with operational testing and commissioning periods as specified.
 - 1. Classes shall be scheduled such that classroom sessions are interspersed with field instruction in logical sequence.
 - 2. Arrange to have the training conducted on consecutive days, with no more than six (6) hours of classes scheduled for any one day.
 - 3. Concurrent classes shall not be allowed.

3.03 CLASSROOM TRAINING

- A. As a minimum, classroom equipment training for operations personnel will include the following services for each item of equipment and/or system as required in individual Specification sections:
 - 1. Using slides and drawings, discuss the equipment's specific location in the plant and an operational overview. Discuss purpose and function of the equipment. Provide a working knowledge of the operating theory of the equipment.
 - 2. Operator prestart, startup, shutdown, post shutdown, normal, and emergency operating procedures, including a discussion on system integration and electrical interlocks, if any.

3. Identify and discuss safety items and procedures.
 4. Routine preventive maintenance, including specific details on lubrication and maintenance. Required equipment exercise procedures and intervals. Operator detection, without test instruments, of specific equipment trouble symptoms. Equipment inspection and troubleshooting procedures including the use of applicable test instruments and the "pass" and "no pass" test instrument readings. Routine and long-term calibration procedures.
 5. Routine disassembly and assembly of equipment if applicable (as judged by the Owner on a case-by-case basis) for purposes such as operator inspection of equipment.
 6. Routine records keeping.
- B. Additional training services shall be provided, where specifically required in individual Specification sections.

3.04 FIELD TRAINING

- A. As a minimum, hands-on equipment training for Owner's operations personnel will include identifying location of equipment and reviewing the purpose of piping, valves, and flow options; identifying instrumentation including location of primary element, location of instrument readout, basic operation, and information interpretation.
- B. Discuss, demonstrate, and perform standard operating procedures and round checks. Discuss and perform the preventive maintenance activities and perform startup and shutdown procedures. Perform the required equipment exercise procedures. Perform routine disassembly and assembly of equipment if applicable. Identify and review safety items and perform safety procedures, if feasible.
- C. Demonstrate preventive maintenance such as lubrication; normal maintenance such as belt, seal, and bearing replacement; and up to major repairs such as replacement of major equipment part(s) with the use of special tools, bridge cranes, welding jigs, etc.
- D. Perform Owner approved practice maintenance and repair job(s), including mechanical and electrical adjustments and calibration and troubleshooting equipment problems.

PART 4 FORMS

4.01 TRAINING FORM

- A. The following form is to be used for Owner's training and record purposes. Digital versions of this form can be obtained upon request to the Engineer.

MANUFACTURER'S CERTIFICATE OF INSTRUCTIONAL SERVICES

PROJECT: _____

EQUIPMENT: _____ (Tag No. _____)

CONTRACTOR: _____

SPECIFICATION SECTION: # _____

ENGINEER: Dewberry Engineers Inc.

MANUFACTURER'S TRAINING CERTIFICATION:

The undersigned manufacturer certifies that a service technician has instructed the treatment plant operating personnel in the proper maintenance and operation of the equipment designated herein, and that the training included, but was not limited to the following:

Operation Check List:

1. _____ Start-up and operation in accordance with the manufacturer's O&M instructions.
2. _____ Shutdown procedure reviewed in accordance with the O&M Manual.
3. _____ Normal operation procedure reviewed.
4. _____ Primary sensing elements, vibration, oil level, temperature, filter, pressure, etc.
5. _____

Maintenance Check List:

1. _____ Described maintenance of this equipment as required by the O&M Manual.
2. _____ Described lubrication and periodic inspection as recommended by the manufacturer.
3. _____ Described preventive maintenance instructions.
4. _____ Described normal items to be reviewed for wear.
5. _____ Described special tools required, if any.
6. _____ Described preventive maintenance instructions.
7. _____ Safety and safe operation of this equipment as recommended by the Manufacturer.
8. _____ Trouble-shooting information and instruction.
9. _____ Hands on training – operation of the equipment by the Owner's operators.
10. _____ Review of the training as specified in the Contract Documents.
11. _____

MANUFACTURER: _____ certifies that conducted training is in compliance with the Contract Documents.

Signature: _____

Title: _____ Date: _____

ENGINEER: Dewberry confirms the training as presented is in compliance with the Contract Documents.

Engineer Signature: _____

Title: _____ Date: _____

Engineer Signature: _____

Title: _____ Date: _____

OWNER: Town of Superior representative accepts the training as presented by the manufacturer's representative.

Owner Signature: _____

Title: _____ Date: _____

CONTRACTOR: _____ certifies that training as presented is in compliance with the Contract Documents.

Signature: _____

Title: _____ Date: _____

END OF SECTION

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE

- A. This Specification section specifies installation, testing, and commissioning of all mechanical, electrical and instrumentation systems. Testing and commissioning includes delivery acceptance tests and inspections, tests and inspections of items as installed, operational testing of completed sections of the facility, and commissioning of completed sections of the plant.

1.02 QUALITY ASSURANCE

A. Manufacturers' Operation and Maintenance Instructions

1. The Contractor shall have copies of operating and maintenance instructions from the manufacturers of all equipment to be installed, tested, and commissioned.
 - a. Operating instructions shall include equipment start-up, normal operation, shutdown, emergency operation and troubleshooting procedures.
 - b. Maintenance instructions shall include equipment installation, calibration and adjustment, preventive and repair maintenance, lubrication, and troubleshooting procedures as well as parts lists.
 - c. No startup or commissioning shall commence until a manufacturer's representative has visually inspected the installation, verified his approval of the installation by reviewing lubrication, filtration, and adjustment of all components. The manufacturer's representative must then start the equipment to assure it meets all of the manufacturer's recommendations, sign the provided compliance sheet, and inform the Engineer the equipment is ready for testing, training, and commissioning.
2. Related information shall be assembled for this Project in accordance with Specification Section 01 78 23.

B. Installation

1. All mechanical, electrical, and instrumentation equipment shall be installed in conformity with the details shown and specified in the Contract Documents and with the manufacturer's requirements.

C. Testing

1. All materials, equipment, and Work provided and/or installed as a part of this Contract shall be tested and inspected to demonstrate compliance with the Contract requirements. The Work shall include the equipment supplied by others but installed and/or connected by the Contractor. For the purpose of this Specification section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or device requiring an electrical, pneumatic or hydraulic connection.
2. Installed piping leakage tests and other piping tests shall be as specified in the Specification sections included in Division 33.

3. No tests specified herein shall be conducted until the item/system to be tested has been inspected and approval for the application of such test has been given by the Engineer.
4. Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry.
5. The Contractor shall see that scheduling and performance of all tests are coordinated with involved Subcontractors and Suppliers and other involved contractors.
6. The form of evidence of satisfactory fulfillment of requirements for delivery acceptance tests and inspections and tests and inspections of items installed shall be at the discretion of the Engineer, either by tests and inspections carried out in their presence or by their favorable acknowledgment of certificates or reports of tests and inspections carried out by others. Provide forms which indicate all test information, including specified operational parameters that are acceptable in content to the Engineer.

1.03 SUBMITTALS

- A. The following information shall be submitted in accordance with the provisions of Specification Section 01 33 00:
 1. A complete description of the Contractor's plan for documenting the results from the test program in conformance with the requirements of this Specification section, including:
 - a. Proposed plan for documenting the calibration of all test instruments.
 - b. Proposed plan for calibration of all instrument systems, including flow meters; level sensors; and pressure, weight, and analysis systems.
 - c. Sample forms for documenting the results of field pressure and performance tests and all other test forms required herein.
 2. Pre-operational check-out procedures reviewed and approved by the respective equipment manufacturers.
 3. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by the Contractor for the systematic testing of all equipment and systems installed under this Contract.
 4. A schedule and subsequent updates, presenting the Contractor's plan for testing the equipment and systems installed under this Contract. The schedule shall establish the expected time period (calendar dates) when the Contractor plans to commence operational testing of the completed systems, along with a description of the temporary systems and installations planned to allow operational testing to take place. This schedule must be received at least four (4) weeks before testing begins.
 5. Completed test forms shall be provided for each item of mechanical, electrical, and instrumentation equipment provided or installed under this Contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests. Separate sections shall be provided to record values for the preparation checkout and initials of representatives of the equipment manufacturers, the Contractor, and the Engineer.
 6. Completed Certificate of Installation, Inspection and Start-Up Services for each equipment installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gages, Meters, Recorders, and Monitors

1. Provide gages, meters, recorders, and monitors as required by the Contract Documents and as required by the Engineer to supplement or augment the instrumentation system(s) provided under this Contract to properly demonstrate that all equipment satisfies the requirements of the Project Manual.
 - a. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to provide a level of precision and accuracy consistent with the variables to be monitored.
 - b. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the certainty of instruments employed for testing purposes. Calibration procedures shall be in accordance with applicable standards of ASTM, ISA, and IEEE.
2. The adequacy of all gages, meters, recorders, and monitors shall be subject to review of the Engineer.

B. Records

1. Provide test forms for all installed and operational testing for each item of mechanical, electrical, and instrumentation equipment provided or installed under this Contract. Separate sections shall be provided to record values for the preparation checkout and initials of representatives of the equipment manufacturers, the Contractor, and the Engineer.
2. The Contractor shall maintain a master file of all equipment test forms, which shall be available for inspection by the Engineer. Upon completion of testing, the Contractor shall furnish the Engineer with the original and two copies of the test form for each equipment item.

2.02 METHODS

A. Installation

1. All equipment shall be installed by workers properly skilled in the trades and professions required to assure first-class workmanship. Where required by detailed Specifications or manufacturer requirements, installation of specific equipment item(s) shall be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturer(s). The Contractor shall be prepared to document the skills and training of all workers engaged in the installation of all equipment furnished either by the Contractor or the Owner.

B. Testing

1. Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures.
 - a. Test all equipment, systems, structures, and the complete facility as a unit in an orderly, systematic manner.
 - b. Each individual step in the procedures shall be witnessed by a representative of the Engineer.

2. During the facility operational testing period, all equipment and systems shall be operated, to the greatest extent practicable, at conditions which represent the full range of operating parameters as defined by the Project Manual.

PART 3 EXECUTION

3.01 NOTIFICATION

- A. The Contractor shall notify the Engineer not less than 14 days prior to the date that the equipment and/or other materials or portions of the Work will be ready for inspection and testing.

3.02 ACCEPTANCE TESTS AND INSPECTIONS

- A. Acceptance tests and inspections shall be performed by the Engineer of all items delivered at the Site or to any authorized place of storage to confirm that such items are of the specified quality and workmanship. Should the Engineer find, in their opinion, indication of damage or deficient quality of workmanship, the Contractor shall provide the necessary documentation or conduct such tests deemed necessary by the Engineer to demonstrate compliance with the Contract Documents.
- B. Tests of items at the place of manufacture during and/or on completion of manufacture shall be conducted.
 1. Tests shall comprise of material tests, hydraulic pressure tests, electric and instrumentation subsystem tests, performance and operating tests and inspections in accordance with the relevant standards of the industry and more particularly as detailed in individual clauses of the Specifications.
 2. Results of tests shall satisfy the Engineer that the items tested and inspected comply with the requirements of the Contract Documents.

3.03 INSTALLED TESTS AND INSPECTIONS:

A. General

1. All equipment installed by the Contractor shall be tested to the satisfaction of the Engineer before any facility is put into operation.
2. Tests shall be made to determine whether the equipment has been properly assembled, aligned, adjusted, and connected.
3. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the Work.
4. Contractor will not be allowed to start up equipment or systems until the final Operation and Maintenance Manuals (O&M Manuals) have been received in accordance with Specification Section 01 78 23.
5. Provide temporary heating, ventilating, and air conditioning, utilities, supplies, labor and Work for the areas requiring these services. Temporary facilities shall be maintained by the Contractor until permanent systems are in service.

B. Start-Up Plan

1. The procedures shall be divided into three distinct stages; preparation checkout, initial operation, and plant operational tests.

2. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged.
3. Once the testing procedures have been reviewed by the Engineer, the Contractor shall produce checkout, alignment, adjustment, and calibration signoff forms for each item of equipment to be used in the field by the Contractor, Engineer jointly to ensure that each item of electrical and mechanical equipment has been properly installed and tested.

C. Preparation Checkout

1. The procedures shall provide a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation.
2. Preparation checkout procedures shall include, but not necessarily be limited to:
 - a. Electrical and instrumentation system testing as specified in Specification sections included in Divisions 26 and 40.
 - b. Piping system pressure testing and cleaning as specified in Specification sections included in Division 33.
 - c. Alignment of equipment.
 - d. Preparation lubrication.

D. Initial Operation

1. Once all affected equipment has been subjected to the required preparation checkout procedures and the Engineer has witnessed the checkout and has not found deficiencies in that portion of the Work, individual systems may be started and operated under simulated operating conditions.
 - a. Nonpotable water shall be employed for the testing of all liquid systems except gaseous, oil or chemical systems.
 - b. Test media for these systems shall either be the intended fluid or a compatible substitute.
 - c. The equipment shall be operated for a sufficient period of time to determine machine operating characteristics including temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls.
 - d. When testing requires the availability of auxiliary systems such as electrical power, flushing or cooling water or control air that have not yet been placed in service, provide acceptable substitute sources capable of meeting the requirements of the machine, device, or system.
 - e. Disposal methods for test media shall be subject to review by the Engineer.
2. Test results shall be within the specified tolerances.
 - a. If tolerances have not been specified, test results shall conform to tolerances established by the equipment manufacturer or recognized industry practice.
 - b. Where the results of any installed test fails to comply with the Contract requirements for such test, then such repeat testing as may be necessary to achieve the Contract requirements shall be made at the expense of the Contractor.
 - c. In case of any doubt, dispute, or difference of opinion regarding test results, test methods, or test equipment, the Engineer may order the test to be repeated.

- 1) If the repeat testing, using such modified methods or equipment as the Engineer may require, substantially confirms the previous test results, then all costs in connection with the repeat testing will be paid by the Owner.
3. Once initial operation has been completed, all machines shall be rechecked for proper alignment, realigned, if necessary, and doweled in place.
 - a. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics.
 - b. Any deficiencies shall be corrected to the satisfaction of the Engineer.
 - c. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled, inspected, and then repaired.
 - d. Equipment that cannot be acceptably repaired shall be removed from the Site and replaced.
4. If any portion of the Work should fail to fulfill the Contract requirements during testing and adjustments or alterations are made, or if any portion of the Work is renewed or replaced, tests on that portion, together with all other affected portions of the Work, shall be repeated within a reasonable time in accordance with the specified conditions.

E. Operational Testing

1. After completion of all initial testing and the Engineer concurs that all equipment complies with the requirements of the Specifications, the Contractor shall fill all process systems and units with the specified fluid.
 - a. Process systems and units include all materials and equipment constructed or installed in the Contract, including Owner-provided equipment.
2. Upon completion of the filling operations, operate the completed systems and subsystems as a complete facility at various loading conditions, as directed by the Engineer.
3. All process units and systems shall be brought to full operating conditions, including temperature, pressure, and flow.
4. The duration of the operational test shall be at least three (3) days.
 - a. Each test day the complete facility shall be operated for at least eight (8) continuous hours.
 - b. During the three (3)-day period, the Contractor shall demonstrate the operation of all equipment and all systems installed under this Contract.
5. If operational testing is stopped for any reason related to the temporary testing systems, or the facilities or equipment furnished under this Contract, the operational testing program shall be repeated until the specified continuous period has been accomplished without interruption.
6. Once a system or subsystem has successfully completed the three (3)-day test period in the opinion of the Engineer, the Engineer shall issue a certificate of Partial Substantial Completion for the system or subsystem.
7. All costs for water, fuel, power, and chemical required during this plant operational test shall be borne by the Owner. The Contractor shall obtain nonpotable or potable water required to complete tests and inspections from the Owner. Arrangements shall be made through the Engineer.

3.04 OPERATIONAL INSTRUCTION

- A. During the testing of equipment, provide experienced factory-trained manufacturer's representatives of the various equipment items, or other qualified persons to instruct the Owner's personnel in the operations and care thereof. Training shall be in accordance with the requirements of Specification Section 01 79 00.

3.05 COMMISSIONING

A. General

1. After completing operational testing and certification of all systems and subsystems as Partially Substantially Complete, commissioning will begin. The facility or portion thereof shall be fully operational and performing all functions as specified.
2. The commissioning period for all systems shall be 14 days and commence following the certification of Partial Substantial Completion of all portions of the facility.
3. Contractor shall remove all temporary piping or other temporary facilities that may have been in use during the operational testing.
4. Contractor shall bear the costs of all necessary repairs or replacements, including labor and materials, required to keep operational the portion of the plant being commissioned.

- B. During the commissioning period, the Contractor shall provide on-call personnel including equipment manufacturer service representatives available 24 hours per day, seven (7) days per week for troubleshooting or emergency repair and maintenance of equipment.

1. On-call personnel assigned for troubleshooting, repair, or maintenance of equipment shall respond as soon as possible and in no case longer than 8 hours after notification to the Contractor.
2. On-call personnel shall be familiar with the facility equipment and operations and shall be acceptable to the Engineer.
3. In response to a request from the Engineer or Owner, on-call personnel shall be present at the Site for whatever period of time is required at whatever time of day necessary to restore normal operation of equipment.

- C. During the commissioning period, the Owner shall:

1. Provide Owner's operations and maintenance personnel who will be responsible for operation of the plant or portion of the plant being operated during this commissioning period.
2. Be responsible for all normal operational costs.

- D. At the end of the commissioning period and when all corrections required by the Engineer to assure a reliable and operational facility are complete, the Engineer shall issue a Certificate of Substantial Completion for the facility as a whole.

PART 4 FORMS

4.01 INSPECTION AND COMMISSIONING FORMS

- A. The following form is to be use for procedurally conducting inspections and commissioning, and for documentation purposes.

1. Certificate of Installation, Inspection and Start-Up Services to be used to document completing operational testing, certification, and commissioning for each item of mechanical, electrical, and instrumentation equipment provided or installed under this Contract.
- B. A digital version of these forms can be obtained upon request to the Engineer.

CERTIFICATE of INSTALLATION, INSPECTION and START-UP SERVICES

PROJECT: _____

EQUIPMENT: _____ (Tag No. _____)

SPECIFICATION SECTION: # _____

CONTRACTOR: _____

OWNER: Town of Superior

ENGINEER: Dewberry Engineers Inc

MANUFACTURER'S EQUIPMENT CERTIFICATION

The undersigned manufacturer of the equipment item described above hereby certifies that the representative whose signature appears below has checked the installation of the equipment and that the equipment as specified in the Project Manual, has been provided in accordance with the manufacturer's recommendations and that the trial operation of the equipment item has been satisfactory.

Comments: _____

Manufacturer: _____

Authorized Representative (printed name) _____

Title _____

Signature _____

Date _____

Contractor: _____

Authorized Representative (printed name) _____

Title _____

Signature _____

Date _____

CERTIFICATE of INSTALLATION, INSPECTION and START-UP SERVICES

PRE-OPERATION SYSTEM READINESS CHECK-OFF

PROJECT: _____ Date _____

EQUIPMENT: _____ (Tag No. _____)

- | | | | | | |
|-----|--|-------|-------|-------|-------|
| 1. | The equipment is installed in accordance with the manufacturer's recommendations, approved Shop Drawings and Contract Documents. | _____ | _____ | _____ | _____ |
| 2. | The equipment has been lubricated, and operated meeting the start-up criteria of the manufacturer. | _____ | _____ | _____ | _____ |
| 3. | Nothing in the installation voids any warranty | _____ | _____ | _____ | _____ |
| 4. | The equipment has been operated in the presence of the Engineer. | _____ | _____ | _____ | _____ |
| 5. | The equipment, as installed, is ready to be operated by others. | _____ | _____ | _____ | _____ |
| 6. | The manufacturer's start-up report is completed. | _____ | _____ | _____ | _____ |
| 7. | The equipment is ready for Start-up and Training. | _____ | _____ | _____ | _____ |
| 8. | The primary sensing elements are operational. | _____ | _____ | _____ | _____ |
| 9. | _____ | _____ | _____ | _____ | _____ |
| 10. | _____ | _____ | _____ | _____ | _____ |

CERTIFICATE of INSTALLATION, INSPECTION and START-UP SERVICES

START-UP SERVICES

PROJECT: _____ Date _____

EQUIPMENT: _____ (Tag No. _____)

- 1. The equipment pre-operation system readiness check-off has been conducted in accordance with the manufacturer's recommendations. _____
- 2. The equipment has been started up in the presence of the Engineer. _____
- 3. The manufacturer's start-up report is completed and attached to this certification form. _____
- 4. The equipment has been successfully started up and is ready to be operated by others. _____

END OF SECTION

SECTION 02 42 00

RESTORATION AND CLEAN-UP

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies site restoration and clean-up that consists of construction and debris removal, site finishing, road clean-up during construction, and dust prevention.
- B. In the event of failure of the CONTRACTOR to complete work, correct deficiencies, or clean up a project site within a reasonable time period, the OWNER has the right to draw upon the performance guarantee.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SITE RESTORATION AND CLEAN-UP

- A. The grade and condition of all unsurfaced areas shall be restored to a condition equal to or better than the grade and condition immediately prior to construction, unless otherwise shown in the approved plans and to the satisfaction of the OWNER.
- B. Stockpile excavated materials causing the least damage to adjacent grassed areas, driveways, or fences regardless of whether these are on private property or public rights-of-way. Remove excavated materials from grassed and planted areas. Leave these surfaces in a condition equivalent to their original condition.
- C. Reopen existing drainage ditches and culverts and restore grade and natural drainage as soon as possible after disturbance. Restore culverts broken or damaged to original or better condition and location.
- D. Re-grade, rake, and drag disturbed areas free from rocks, gravel, clay or any other foreign material and in their original condition. Remove temporary structures, temporary fencing, rubbish, and waste materials. Grade disturbed areas to blend in with the abutting undisturbed property. The finished surface shall be free-draining and free from holes, ruts, rough spots, or other detrimental surface features.
- E. Restore and clean-up work site not more than 90 days following completion of major construction activities.

3.02 ROAD CLEAN-UP DURING CONSTRUCTION

- A. All pavement and concrete flatwork shall be restored or replaced to a condition equal to or better than before the work began and to the satisfaction of the OWNER.

3.03 DUST PREVENTION

- A. The CONTRACTOR shall take all necessary steps to control dust that arises from operations connected with the work. When ordered by the OWNER, the CONTRACTOR shall dust control

the construction area by sprinkling the site with water, by constructing windrows, applying soil binders, or as otherwise directed by the OWNER.

END OF SECTION

SECTION 03 00 55

ADHESIVE BONDING OF REINFORCEMENT AND ALL THREAD RODS IN CONCRETE

PART 1 GENERAL

1.01 SCOPE

- A. This section covers bonding reinforcing bars and all thread rods in concrete using epoxy adhesive.

1.02 QUALITY ASSURANCE

A. References

1. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of referenced publications in effect at the time of the bid shall govern. In case of conflict between the requirements of this section and the listed standards, the requirements of this section shall prevail.

- a. International Code Council – Evaluation Service, Inc. (ICC-ES):
 - 1) AC308 Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements
- b. ASTM International:
 - 1) C881 Standard Specification for Epoxy Resin Base Bonding System for Concrete
- c. Society for Protective Coatings (SSPC):
 - 1) SP-1 Surface Preparation Standards – Solvent Cleaning

B. Definitions

1. Evaluations Report: Report prepared by ICC-ES, the documents testing and review of the adhesive product to confirm that it conforms to the requirements of ICC-ES AC58.

1.03 SUBMITTALS

- A. The Contractor shall submit the information below in accordance with Section 01 33 00, Submittal Procedures.

1. Product Data

- a. Submit technical data for adhesives, including:
 - 1) Independent testing laboratory results indicating allowable loads in tension and shear for masonry walls of the types shown on the Drawings, with load modification factors for temperature, spacing, edge distance and other variables.
 - 2) Handling and storage instructions.
 - 3) Installation instructions.
- b. Quality control submittals:

- 1) Special inspections: Detailed instructions for special inspection to comply with the California Building Code.
- 2) Evaluation report confirming that the product complies with the requirements of ICC-ES AC308.

1.04 DELIVERY AND HANDLING

A. Store and protect as follows, unless manufacturer has stricter requirements.

1. Store adhesive components on pallets or shelving in a covered-storage area protected from weather.
2. Control temperature to maintain storage within manufacturer's recommended temperature range.
 - a. If products are stored at temperatures outside manufacturer's recommended temperature range, test components prior to use by methods acceptable to the Engineer to determine if the products still meet specified requirements.
3. Dispose of products that have passed their expiration date.

1.05 PROJECT CONDITIONS

A. Seismic design category as shown on the Drawings.

PART 2 PRODUCTS

2.01 MATERIALS

A. Adhesive system

1. Adhesive shall have a current Evaluation Report showing compliance with ICC-ES AC308 for use in cracked concrete and for seismic design categories as shown on the Drawings.
2. Materials
 - a. In accordance with ASTM C 881, Type IV, Grade 3, Class B or C depending on site conditions.
 - b. 2-component, 100 percent solids, insensitive to moisture.
 - c. Cure temperature, pot life, and workability: compatible with the required use and the environmental conditions.

B. Packaging

1. Furnished in side-by-side cartridges with resin and hardener components isolated until mixing through manufacturer's static mixing nozzle. Nozzle designed to thoroughly blend the components for injection from the nozzle directly into prepared hole.
2. Container markings that include manufacturer's name, product name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

C. Manufactures

1. One of the following or equal:
 - a. Hilti, Inc.: RE – 500 V3 Adhesive Anchor System.
 - b. Simpson Strong-Tie Company, Inc.: SET-XP.

D. All Thread Rods

1. As specified in Section 05100, Structural and Miscellaneous Metals.

E. Reinforcing Steel

1. As specified in Section 03200, CONCRETE REINFORCEMENT.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide epoxy adhesive packaged that is disposable, self-contained cartridge system capable of dispensing both epoxy components in the proper mixing ratio, and fit into a manually or pneumatically operated caulking gun. Dispense components through a mixing nozzle that thoroughly mixes components.

3.02 HOLE SIZING AND INSTALLATION

A. Drilling Holes

1. Determine location of reinforcing bars or other obstructions with a non-destructive indicator device, and mark locations on surface of concrete. Do not damage or cut existing reinforcing bars, electrical conduits, or other items embedded in the existing concrete without approval by Engineer.

B. Hole drilling equipment

1. Electric or pneumatic rotary impact type with medium or light impact. Drill bits to be Carbide tipped in accordance with ANSI B212-15 unless otherwise recommended by the manufacture or required as a "condition of use" in the ICC Evaluation Report submitted. Hollow drill bits with flushing air systems are preferred. Air supplied to hollow drill bits shall be free of oil, water, or other contaminants that will reduce the bond. Where edge distance are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.
2. Hole diameter to be the reinforcing bar diameters or all thread rod diameter plus 1/8 inch.

C. Obstructions in drill path

1. If an existing reinforcing bar or other obstruction is hit while drilling hole, stop drilling hole and fill the hole with drypack mortar. Relocate the hole to miss the obstruction and drill another hole. Repeat the above until the hole has been drilled to the required depth.
2. Avoid drilling an excessive number of holes in an area of a structural member, which would excessively weaken the structural member and endanger the stability of the structure. Drypack holes which hit obstructions and allow drypack to reach strength equal to the existing concrete before drilling adjacent holes. Epoxy grout may be substitute for drypack with acceptable to engineer.

3. Install reinforcing bars and all thread rods to depth, spacings, and locations as indicated on the Drawings. Do not install epoxy bonded all-thread rods or reinforcing bars in overhead applications.

3.03 INSTALLATION

A. Cleaning holes

1. Insert long air nozzle into hole and blow out loose dust. Use Compressed air that is free of oil, water or other contaminants that will reduce the bond. Use a stiff brush to brush hole to dislodge compacted drilling dust, then use compressed air again. The final hole shall be clean and dry before installation.

B. Cleaning reinforcement and all thread rods

1. Solvent clean reinforcing bar and all thread rods over the embedment length in accordance with SSPC SP-1 Solvent Cleaning. Provide an oil and grease free surface to promote bonding of adhesive to steel. Clean reinforcing bars and all thread rods over embedment length to bare metal. The reinforcing bars and all thread rods shall be free oil, grease, paint, dirt, mill scale, rust or other coatings that will reduce the bond.

C. Filling hole with epoxy

1. Fill hole with epoxy before inserting the reinforcing bar or all thread rod. Fill hole with epoxy starting from bottom of hole. Fill hole without creating air voids. Fill hole with sufficient epoxy so that excess epoxy is extruded out of the hole when the reinforcing bar or all thread rod is inserted into the hole. Prior to installing epoxy, installer shall be trained by manufactures representative.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE

- A. This section specifies the work necessary to furnish, place, and remove all formwork for cast-in-place concrete.

1.02 QUALITY ASSURANCE

A. References

1. The publications referred to hereinafter form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only. The latest edition of the referenced publications in effect at the time of bid shall govern. In case of conflict between the requirements of this section and the listed standards, the requirements of this section shall prevail.
2. American Concrete Institute (ACI) publications:
 - a. ACI-347 Recommended Practice for Concrete Formwork
3. International Conference of Building Officials (ICBO) Publications:
 - a. 2013 CBC California Building Code, 2013 Edition
4. U.S. Project Standard (PS) Publications:
 - a. PS-1 Product Standard for Construction and Industrial Plywood

B. Regulatory Requirements

1. The Contractor shall comply fully with the requirements of Section 1717 of the Construction Safety Orders, State of California, Department of Industrial Relations, regarding the design of concrete forms, falsework and shoring, and the inspection of same prior to placement of concrete. Where the said section 1717 requires the services of a civil engineer registered in the State of California to approve design calculations and working plans of the falsework or shoring system, or to inspect such system prior to placement of concrete, the Contractor shall employ a registered civil engineer for these purposes, and all costs therefore shall be included in the price named in the Contract for completion of the work as set forth in the Contract Documents.
2. Except as modified by the requirements specified herein and/or the details on the plans, concrete formwork shall conform to the California Building Code (CBC), Chapter 19, "Concrete", Referenced Edition, and the American Concrete Institute – 347 (ACI-347), Recommended Practice for Concrete Formwork.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 01 33 00. The Contractor shall submit mill affidavits stating the grade and physical properties of form materials before the materials are delivered to the site. The affidavits shall demonstrate that the materials and procedures comply with the specifications of this section.

1. Information on proposed forming system:

- a. Submit in such detail as the Engineer may require to assure that the intent of the Specifications herein can be complied with for the proposed concrete forms.
 - b. Alternate combinations of plywood thickness and stud spacing may be submitted.
2. Form release agent.

PART 2 PRODUCTS

2.01 MATERIALS

A. Forms for Exposed Finish Concrete

1. Unless otherwise indicated, construct formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on plans. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.
2. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood", Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark. Use full size 4-foot by 8-foot plywood sheets, except where smaller pieces are able to cover the entire area.
3. Studs and wales shall be a minimum 2-inch by 4-inch lumber and contain no loose knots and be free of warps, cups, and bows.

B. Forms for Unexposed Finish Concrete

1. Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal, or other acceptable material as determined by the Construction Representative. Provide lumber dressed on at least 2 edges and one side for tight fit.

C. Form Ties

1. Provide factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent deflection, and to prevent spalling concrete surfaces upon removal.
2. Provide ties so that portion remaining within concrete after removal of exterior parts is at least 1-1/2 inch from the outer concrete surface. Provide form ties which will leave a hole not larger than 1 in. diameter in the concrete surface. Provide neoprene waterseal washer that is located near the center of the concrete. Correctly size the neoprene plugs for taper tie holes, such that after they are driven, plugs are to be located in the center third of the wall thickness.

D. Incidentals

1. External angles:
 - a. Where not otherwise indicated on the Drawings, provide 3/4-inch bevel, formed by true dimensioned wood or solid plastic chamfer strip on walkways, slabs walls beams, columns, and openings.
 - b. At expansion joints, provide 1/4-inch bevel formed by true dimensioned wood or solid plastic chamfer strip.

E. Form Release Agent

1. Provide commercial formulation formcoating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

PART 3 EXECUTION

3.01 INSTALLATION OF FORMS

A. General

1. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by concrete structure. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation, and position.
2. Design formwork to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
3. Construct forms in compliance with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
4. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
5. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
6. Chamfer all exposed corners and edges with 3/4 inch chamfers unless otherwise noted on the plans, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Fillets are not required unless otherwise noted on the drawings.

B. Exposed Surface Form Tolerances

1. Forms for exposed concrete surfaces shall be designed and constructed so that the formed surface of the concrete does not undulate excessively in any direction between studs, joists, form stiffeners, form fasteners, or wales. Undulations exceeding either 3/32 in. or 1/270 of the center to center distance between studs, joists, form stiffeners, form fasteners or wales will be considered to be excessive. Should any form or forming system, even though previously approved for use, produce a concrete surface with excessive undulations, its use shall be discontinued until modifications satisfactory to the Construction Representative have been made. Portions of concrete structures with surface undulations in excess of the limits herein may be rejected by the Construction Representative.

C. Form Ties

1. Install factory-fabricated, adjustable-length, removable or snapoff metal form ties, designed and spaced to prevent form deflection, and to prevent spalling concrete surfaces upon removal.

D. Provisions for Other Trades

1. Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.

E. Cleaning and Tightening

1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retighten forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.02 PREPARATION OF FORM SURFACES

1. Coat contact surfaces of forms with a form-coating compound before reinforcement is placed.
2. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
3. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.03 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 100°F for 24 hours after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joints, slabs and other structural elements, may not be removed in less than 14 days and until the concrete has attained design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- C. Form facing material may be removed 4 days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.
- D. Removal of form ties from surfaces, fill holes as follows:
1. Remove form ties from surfaces.
 2. Roughen cone shaped tie holes by sandblasting before repair.
 3. Dry pack cone shaped tie holes with dry-pack mortar. Mix proportions for dry pack mortar to be by weight of 1 part Portland cement to two parts of concrete sand. Use only enough

water so that resulting mortar will crumble to the touch after being formed into a ball by hand.

3.04 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE, REINFORCEMENT, AND GROUT

PART 1 GENERAL

1.01 SCOPE

- A. This Section specifies cast-in-place concrete and reinforcement for footings, slabs, floors, walls, channels, pavements, sidewalks, curbs, pipe bedding encasement, electrical conduit encasement, and miscellaneous structures.

1.02 QUALITY ASSURANCE

A. Quality Control by Contractor

- 1. All concrete testing will be done in accordance with the General Conditions to demonstrate conformance with the specified requirements for cast-in-place concrete. The Contractor shall provide the services of Owner and Engineer approved independent testing laboratory shall comply with the requirements of ASTM E329. Costs of testing laboratory services shall be borne by Owner.

B. Basis for Quality

- 1. Cast-in-place concrete shall conform to the requirements of ACI 301, except as modified. Unless specified otherwise, all formwork shall conform to ACI 347.

C. References

- 1. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ACI 211.1	Recommended Practice for Selecting Proportions for Normal and Heavy Weight Concrete
ACI 301	Specifications for Structural Concrete for Buildings
ACI 305R	Hot Weather Concreting
ACI 306R	Cold Weather Concreting
ACI 315	Details and Detailing of Concrete Reinforcement
ACI 347	Concrete Formwork
ACI 350	Code Requirements for Structural Concrete and Commentary
ASTM A185	Steel Welded Wire, Fabric, Plain for Concrete Reinforcement
ASTM A615/A615M	Deformed and Plain Billet Steel Bars for Concrete Reinforcement
ASTM C31	Standard Method of Making and Curing Concrete Test Specimens in the Field
ASTM C33	Concrete Aggregates
ASTM C39	Standard Test for Compressive Strength of Cylindrical Concrete Specimens
ASTM C42	Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
ASTM C94	Ready Mixed Concrete
ASTM C136	Sieve Analysis of Fine and Coarse Aggregates
ASTM C143	Standard Test for Slump of Portland Cement Concrete
ASTM C150	Portland Cement

ASTM C172	Sampling Fresh Concrete
ASTM C260	Air Entraining Admixtures for Concrete
ASTM C309	Liquid Membrane Forming Compounds for Curing Concrete
ASTM C494	Chemical Admixtures for Concrete
ASTM D75	Standard Practice for Sampling Aggregates
ASTM E329	Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction
CRSI PRB	Placing Reinforcing Bars
CRSI MSP 1	Manual of Standard Practice

1.03 SUBMITTALS

- A. Mix Design: Reports of concrete mix designs shall be provided in accordance with Section 01 33 00. Requirements for the reports are specified in paragraph 03 30 00 2.02 D.
1. Full details, including mix design calculations for concrete mixes proposed for each class of concrete used.
 2. Include information on correction of batching for varying moisture content of fine aggregates.
 3. Include calculations for required compressive strength f'_{cr} , based on past test records from same source.
 4. Compressive strength test results f'_c , for trial batch or from prior performance of the proposed mix design.
- B. Drying shrinkage test data.
- C. Sieve analysis:
1. Submit sieve analyses of fine and coarse aggregates being used in triplicate at least every 3 weeks and at any time there is significant change in grading of materials.
- D. Manufacturer's Data: Copies of manufacturer's data shall be provided for the following:
1. Curing compounds
 2. Bonding compounds
 3. Admixtures
 - a. Admixtures shall conform to ASTM C494, be of a type that increases workability and reduces water demand of concrete but will not increase shrinkage. Admixtures shall be subject to approval as to type and amount used. Admixtures shall contain no more than 1% chloride ions.
- E. Test Reports: Three copies of reports from the concrete supplier shall be provided certifying that all concrete materials comply with the specifications and all test requirements. Concrete aggregate tests shall not be more than 90 days old.
1. Coarse aggregate:
 - a. Abrasion loss.
 - b. Clay lumps and friable particles.
 - c. Coal and lignite.
 - d. Materials finer than 200 sieve.

- e. Reactivity.
 - f. Shale and chert.
 - g. Soundness.
2. Fine aggregate:
- a. Clay lumps.
 - b. Color.
 - c. Decantation.
 - d. Reactivity.
 - e. Shale and chert.
 - f. Soundness.
- F. Ready mixed Concrete Truck Delivery Tickets: Each load of ready mixed concrete delivered to the job site shall be accompanied by a delivery ticket showing the information listed in ASTM C94, Section 16.
- G. Fly ash and slag Certificate of Compliance: Identify source of material and certify compliance.
- H. For conditions that promote rapid drying of freshly placed concrete such low humidity, high temperature, and wind: Corrective measures for use prior to placing concrete.
- I. Placing Drawings: The Contractor shall prepare reinforcement placing drawings conforming to the requirements of ACI 315. Placing drawings shall include bar lists, schedules, bending details, placing details, and placing plans and elevations as required to fully delineate this portion of the work.
- J. Cold weather concreting:
- 1. Procedures for the production, transportation, placement, protection, curing and temperature monitoring for concrete during cold weather.
 - 2. Procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
- K. Hot weather concreting:
- 1. Procedures for production, placement, finishing, curing, protection, and temperature monitoring for concrete during hot weather and appropriate corrective measures.
- L. Certified Mill Test Reports: The Contractor shall submit certified mill test reports for the reinforcement supplied.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement: Cement shall be Portland Cement, ASTM C150, Type I-II LA, unless otherwise indicated on the Drawings.
- 1. The cement shall not contain more than 0.60% by weight of alkalis, calculated as the percentage of Na_2O plus 0.658 times the percentage of K_2O when determined by either

direct intensity flame photometry or by the atomic absorption method. The instrument and procedure used shall be qualified as to precision and accuracy in accordance with the requirements of ASTM C114.

2. The autoclave expansion shall not exceed 0.100%.
3. Mortar, containing the portland cement to be used and Ottawa sand, shall not expand in water more than 0.010% and shall not contract in air more than 0.048%.
4. All cement used in the manufacture of cast-in-place concrete for exposed surfaces of like elements of a structure shall be from the same cement mill.
5. Cement shall be protected from exposure to moisture until used. Sacked cement shall be piled to permit access for tally, inspection, and identification of each shipment.

B. Aggregates

1. General: Fine and coarse aggregates shall conform to ASTM C33. Fine and coarse aggregates shall be tested in accordance with ASTM C136. Aggregates shall be non-reactive and shall be washed before use. In lieu of the use of ASTM C227 to determine alkali reactivity of the aggregates as specified therein, the alkali reactivity shall be "innocuous" as determined by ASTM C289. When sources of aggregates are changed, test reports shall be provided for the new material. The tests specified shall be performed prior to commencing concrete work.
2. Fine Aggregate: Fine aggregate shall be hard, dense, durable particles of either sand or crushed stone regularly graded from coarse to fine. Gradation shall conform to ASTM C33. Fine aggregate shall be washed clean, shall be uniformly screen graded. Do not provide aggregate by weight of contaminating substances. In no cases shall total exceed percent listed:
 - a. Remove by decantation (dirt, silt, etc.) up to 3% by weight per ASTM C117.
 - b. Shale or chert up to 1% by weight per ASTM C123
 - c. Clay Lumps up to 1% by weight per ASTM C142
3. Coarse Aggregate: Coarse aggregate shall be hard, dense and durable crushed rock free from injurious amounts of soft and friable particles, alkali, organic matter. Deleterious substances shall not be in excess of the following percentages by weight, and in no cases having a total of all deleterious substances exceeding 2 percent.
 - a. Shale or chert up to 1.25% by weight per ASTM C123
 - b. Coal and lignite up to 0.25% by weight per ASTM C123
 - c. Clay lumps and friable particles up to 0.25% by weight per ASTM C123
 - d. Gradation of each coarse aggregate size specified in paragraph 03 30 00-2.02 B shall conform to ASTM C33-Table 2. Screened aggregate is unacceptable.
 - e. Not exceeding 15 percent by weight, of thin or elongated pieces having length greater than 5 times average thickness.
 - f. Aggregate for Class A and B shall be in accordance with ASTM C33, Size Number 67, except as otherwise specified or authorized by the EOR.
4. Provide unit weight of fine and coarse aggregate that produces in place concrete with weight of not less than 140 pounds per cubic foot.

C. Pozzolan

1. Pozzolan shall be Class F fly ash in accordance with ASTM C618.

D. Admixtures

1. General: Admixtures shall be compatible with the concrete. Calcium chloride or admixtures containing calcium chloride are not acceptable. Admixtures shall be used in accordance with the manufacturer's recommendations and shall be added separately to the concrete mix.grout
2. Water-reducing Admixtures: Water-reducing admixtures shall be ASTM C494, Type A or D, and shall be Master Builders, Pozzolith or Polyheed; or equal.
 - a. Not contain air entraining agents
 - b. Liquid form before adding to concrete mix.
 - c. No decrease in cement is permitted as a result of use of water reducing admixture.
 - d. Super plasticizers are not to be used.
3. Air Entraining Agent: Air entraining agent shall be Master Builders, MB AE10; or equal. The air entraining agent added shall produce, in accordance with ASTM C260, an entrained air content specified in paragraph 03 30 00-2.02 B for each class of concrete.

E. Water: Water for washing aggregate, for mixing and for curing shall be potable and free from oil and deleterious amounts of acids, alkalis, and organic materials.

F. Color Pigment (when required): Pigment for colored concrete by Davis Colors or engineer approved equal. Maximum 2.5 pounds per yard required. Color to be selected by architect during submittal process.

G. Concrete sealer, one of the following or equal:

1. Euclid Chemical Co. Diamond Hard.
2. L&M Construction Chemicals, SealHard

H. Evaporation retardant, one of the following of equal:

1. Sika, Antisol ER 50.
2. Euclid chemical Co., Eucobar

2.02 CONCRETE CHARACTERISTICS

A. Mix Proportioning: Concrete shall be normal weight concrete composed of specified cement, admixtures, aggregates and water proportioned and mixed to produce a workable, strong, dense, and impermeable concrete.

B. Concrete shall be provided in accordance with the following:

Concrete class	ASTM coarse aggregate size	Min. cement content, sacks/cu yd concrete	Pozzolan, Percent by weight of cement	Maximum water/cement ratio by weight	Air content percent	Slump in inches	Minimum ^a 28-day compressive strength, psi
A	67	6.0	18-20	0.42	5±1	2-4	4,000
B ^b	467	3.25	None	0.65	4±1	4-6	3,000

Notes for table:

- ^a Compressive strength shall be determined at the end of 28 days based on test cylinders made and tested in accordance with ASTM D39.
- ^b Concrete encasement for electrical conduit shall contain 3 pounds of red oxide per sack of cement.

C. Use: Concrete shall be provided by class for the corresponding use listed as follows:

Type of Use	Class of Concrete
Structural Concrete	A
Pipe bedding and encasement, electrical conduit encasement (duct banks) and concrete fill.	B

D. Control. Before beginning concrete work, the Contractor shall determine the proper proportions of materials for class of concrete A and B. Methods for selecting and adjusting proportions of the ingredients shall be in accordance with ACI 211.1. Reports from the concrete supplier of each mix design shall state whether the items reported comply with the specifications and shall show (1) the expected strength, (2) corresponding slump, (3) weights and test results of the ingredients, and (4) other physical properties necessary to check each mix design. Copies of the reports shall be submitted in accordance with paragraph 03 30 00 1.03.

2.03 CURING AND SEALING COMPOUNDS

A. Conforming to ASTM C309. Curing compounds shall be clear and shall be applied in accordance with the manufacturer's instructions, except as otherwise specified.

2.04 BAR REINFORCEMENT

A. Reinforcing bars shall be deformed billet steel in conformance with ASTM A615, including supplementary requirements. Bars shall be Grade 60, except ties or field-bent support bars where specified shall be Grade 40. ASTM A616 or ASTM A617 steel shall not be used. Bars provided as dowels for future construction and bars where specified shall be epoxy-coated in conformance with ASTM A775.

2.05 WIRE AND PLAIN BARS

A. Wire used as reinforcement and bars used as spiral reinforcement in structures shall be cold drawn steel conforming to ASTM A82.

2.06 TIE WIRE

A. The wire shall be minimum 16 gage annealed steel conforming to FEDSPEC QQ W 461H.

2.07 BAR SUPPORTS

A. Bar supports coming into contact with forms shall be CRSI Class 1 plastic protected or Class 2 stainless steel protected and shall be located in accordance with CRSI MSP-1 and placed in accordance with CRSI PRB. Concrete block supports shall be provided for footing and slabs on grade. Stainless steel or plastic protected plain steel supports shall be provided for other work.

2.08 DRYPACK GROUT

A. Drypack grout shall be a mixture of approximately one part cement, 1-1/2 to 2 parts sand, water reducing admixture, and sufficient water to make a stiff workable mix.

2.09 NON-SHRINK GROUT

- A. Non-shrink grout shall have non-metallic aggregate. Acceptable products are SikagROUT 212, by Sika Corporation, Five Star grout; or equal.

2.10 EPOXY GROUT FOR CRACK REPAIR AND DOWEL ANCHORAGE

- A. Except as noted below, epoxy grout shall be a high modulus, two-component, moisture insensitive, 100 percent solids, thermosetting modified polyamide epoxy compound. The consistency shall be a paste form capable of not sagging in horizontal or overhead anchoring configurations. Material shall conform to ASTM C881 Type 1, Grade 3, such as Adhesive Engineering Concrete 1440 series, Sika Corporation Sikadur Hi-Mod Series, Adhesive Technology Corporation Solidbond 200 or equal, and shall have a heat deflection temperature in excess of 130 degrees F.
- B. Epoxy for pressure grouting/crack injection shall be a two component, moisture insensitive, high modulus, injection grade, 100 percent solids, blend of epoxy-resin compounds. The consistency shall be as required to achieve complete penetration in hairline cracks and larger. Material shall conform to ASTM C881 Type 1 Grade 1, such as Sika Corporation Sikadur 52, Adhesive Engineering Company SCB products, Adhesive Technology Corporation SLV 300 series, or equal.

2.11 POLYMER CONCRETE (FOR RESURFACING OR PATCHING)

- A. Polymer concrete (for resurfacing or patching) shall consist of a liquid binder and dry aggregate mixed together to make a mortar or grout of a consistency as required for the application. The liquid binder shall be a chemical and oil resistant, stress relieved, low modulus, moisture insensitive, two-component epoxy-resin compound. The consistency shall be similar to lightweight oil for proper mixing with aggregate. Material shall conform to ASTM C881 Type 3 Grade 1, such as Sika Corporation Sikadur Lo-Mod series, Adhesive Engineering Concrete 1470, Adhesive Technology Corporation 400 series, or equal.

2.12 WATERSTOPS

- A. Hydrophilic waterstops shall be:
 - 1. Adeka Ultra Seal, by Asahi Denka Kogyo K.K.
 - 2. Sika Hydrotite CJ-1020-2K by Sika; or approved equal.
- B. PVC Waterstops
 - 1. PVC waterstops shall be manufactured from virgin polyvinyl chloride (PVC) conforming to the CRD-C572.
 - 2. PVC waterstops in construction joints shall be Sika Greenstreak Type 679, or equal. Waterstops in expansion joints shall be Sika Greenstreak Type 732, or equal.

PART 3 EXECUTION

3.01 GENERAL

- A. Construction of cast-in-place concrete shall be in accordance with the pertinent recommendations contained in ACI Manual of Concrete Practice of 300 Group.

3.02 FABRICATION OF REINFORCING

- A. Reinforcing steel shall not be bent or straightened in a manner which will injure the material. Bars with kinks or with bends not shown shall not be used. Heating or welding bars shall only be permitted where specified or approved by the Engineer. Bars shall not be welded at the bend.

3.03 PLACEMENT OF REINFORCING

- A. Reinforcing steel shall be placed in accordance with CRSI PRB and CRSI MSP-1.
- B. Reinforcing steel shall be positioned accurately and secured against displacement by using annealed iron wire at intersections and shall be supported by concrete or metal chairs, spacers or metal hangers. Tack welding of cross bars is not acceptable. Bars shown on the drawings shall not be repositioned (buried) to act as support bars. Additional bars shall be provided as required for supports. Steel rods and pegs may be used to support reinforcing steel on rock foundations. Reinforcing steel shall be placed in such a manner as to not damage waterproofing membrane or plastic lining which has been previously applied or constructed. Reinforcing steel shall be shop-bent or slightly relocated where necessary to clear waterstop. Reinforcing steel shall not be placed on fresh concrete or forced into fresh concrete.
- C. Supports for embedded items shall not be welded to the reinforcement. Additional reinforcement may be provided for this purpose.
- D. Electrical conduit shall be centered vertically in the slab with a minimum of 2 inches clear all around. Chairs or bolsters shall be provided for this purpose. Conduit shall not be tied directly to reinforcement.

3.04 SPLICING REINFORCING

- A. Reinforcing steel shall be spliced as shown. Additional splices may be provided where approved by the Engineer.
- B. In slabs, beams, girders and walls, reinforcing steel shall not be spliced in areas of maximum stress. Splices of adjacent bars shall be staggered at least one splice length, unless otherwise specified. Splices in welded wire fabric shall be at least 1 1/2 meshes wide.

3.05 CLEANING REINFORCING

- 1. Reinforcing steel shall be cleaned of mill rust scale, dried concrete, or other coatings that may reduce bond. Reinforcement reduced in section is not acceptable. When concrete placement is delayed, reinforcement shall be cleaned by sandblasting if directed by the Engineer.

3.06 CONCRETE

- A. Concrete shall be truck-mixed, ready-mixed concrete conforming to the applicable portions of ASTM C94. Materials shall be proportioned by weighing. The Contractor shall be responsible for producing concrete of the specified characteristics.
- B. Concrete shall be delivered to the site of work, and discharge shall be completed within 1 1/2 hours after introduction of the water to the mixture.

3.07 CONVEYING AND PLACING CONCRETE

- A. Conveying Concrete: Concrete shall be conveyed from the mixer to the forms in accordance with ACI 301, Chapter 8. Concrete which has segregated in conveying shall be removed from the site of the work.
- B. Placing Concrete: Concrete shall be placed in accordance with ACI 301, Chapter 8, and ACI 304, Chapter 6. Pumped concrete shall be the class and consistency specified in paragraph 03 30 00 2.02.
 - 1. Placing Concrete in Hot Weather: In hot weather (above 85 degrees F), concrete shall be placed in accordance with ACI 305R.
 - 2. Placing Concrete in Cold Weather: In cold weather (below 45 degrees F), concrete shall be placed in accordance with ACI 306R.

3.08 CONCRETE FORMWORK

- A. Formwork shall be installed in accordance with ACI 347.

3.09 CURING AND SEALING

- A. General: Concrete curing shall be completed by water curing or by using a clear membrane-curing compound or by a combination of both methods. Repairs or treatment of concrete surfaces shall be coordinated so that interruption of the curing will not be necessary.
- B. Concrete surface temperature shall be maintained between 50 degrees F and 80 degrees F for at least 5 days. Curing concrete in hot weather (above 85 degrees F) shall be in accordance with ACI 305 R. Curing concrete in cold weather (below 45 degrees F) shall be in accordance with ACI 306 F.
- C. Water Curing: When water curing is used, concrete shall be kept wet continuously for a minimum of 10 days after placement. Absorptive mats or fabric may be used to retain moisture during the curing period.
- D. Curing Compound: When curing compound is used, it shall be applied as soon as the concrete has set sufficiently so as not to be marred by the application or immediately following form removal for vertical and other formed surfaces. Preparation of surfaces, quantities used, application procedures, and installation precautions shall be followed in strict compliance with the manufacturer's instructions.
- E. Curing compound shall not be used on concrete surfaces to be coated, waterproofed, or moisture-proofed.

3.10 PROTECTION

- A. Concrete shall be protected from injurious action by sun, rain, flowing water, frost and mechanical injury.

3.11 CONSTRUCTION JOINTS

- A. Construction joint locations shall be coordinated with the Engineer and formed as specified. Wall construction joints shall coincide with stucco joints shown on plan elevations. A rough surface of exposed concrete aggregates shall be produced using a surface retardant at construction joints. The limit of the treated surfaces shall be 1 inch away from the joint edges. Within 24 hours after placing, retarded surface mortar shall be removed either by high pressure water jetting or stiff

brushing or combination of both so as to expose coarse aggregates. A rough surface of exposed aggregate may also be produced by sandblasting followed by high pressure water jetting. Sandblasting, if used, shall remove 1/8 inch of laitance film and shall expose coarse aggregate to insure adequate bond.

- B. Reinforcing steel and welded wire fabric shall be continued across construction joints. Waterstops shall be provided in construction joints at locations as specified.

3.12 EXPANSION JOINTS

- A. Expansion joints shall be as specified. Reinforcement or other embedded metal items bonded to the concrete shall not extend through expansion joints. Waterstops shall be provided in expansion joints as specified in paragraph 03 30 00 2.14.

3.13 INSERTS AND EMBEDMENTS

- A. Inserts: Where pipes, castings or conduits are to pass through structures, the Contractor shall place such pipes or castings in the forms before placing the concrete, or he may provide openings in the concrete for subsequent insertion of such pipes, castings or conduits. Such openings shall be provided with waterstops and construction joint as shown and shall have a slight flare to facilitate grouting and permit the escape of entrained air during grouting.
- B. Additional reinforcement shall be provided around large openings as shown. The grout shall be drypack grout as specified in paragraph 03 30 00-2.10.
- C. Embedments: Gate frames, gate thimbles, special castings, channels or other miscellaneous metal parts that are to be embedded in the concrete shall be set and secured in the forms prior to concrete placement. Unless otherwise specified, anchor bolts and inserts shall be embedded in concrete as shown. The Contractor shall provide inserts, anchors or other bolts necessary for the attachment of piping, valves, metal parts and equipment. Operators or sleeves for gate or valve stems shall be positioned to clear reinforcing steel, conduit and other embedments, and to align accurately with equipment.

3.14 MODIFICATION OF EXISTING CONCRETE

- A. Existing concrete shall be removed, and the remaining surfaces resurfaced as specified. The remaining concrete shall be protected from damage. Clean lines shall be made by sawing through the existing concrete. The concrete may be broken out after initial saw cuts in the event thickness prevents cutting through. Where it is not possible to use a saw, the initial cuts shall be made with chipping hammers. These cuts shall be sufficient to prevent damage to the remaining concrete. In general, an opening in existing concrete shall be oversized 1 inch on all sides and built back to the correct dimension with an epoxy grout. Where oversized openings cannot be made, the concrete shall be cut to the correct dimension, with the exposed reinforcing cut back an additional 1-inch and the resulting hole filled with epoxy grout. Cut or broken concrete surfaces shall be resurfaced with an epoxy grout. Concrete surfaces to be coated shall be dry. Where new concrete adjoins existing concrete surfaces or surfaces which have been cut, such surfaces shall be cleaned by sandblasting to remove laitance, loose coatings and foreign materials, and coated with the bonding compound just prior to the placement of the new concrete. Bonding compounds shall be as specified in paragraph 03 30 00 2.03. Unless otherwise specified, continuity of reinforcing steel shall be obtained across the joint either by exposing existing bars to provide sufficient laps with new bars or by welding existing bars with new bars. Dowels shall be drilled and set with epoxy grout into existing concrete.

3.15 FORMED SURFACE FINISHES

- A. Repair of Surface Defects: Surface defects, including tie holes, minor honeycombing or otherwise defective concrete shall be repaired in accordance with ACI 301, Chapter 9. Areas to be patched shall be cleaned. Patches on exposed surfaces shall be finished to match the adjoining surfaces after they have set. Patches shall be cured as specified for the concrete. All surface protrusions shall be removed from exterior wall surfaces that are to be insulated with expandable foam insulation.
- B. Finishing
 - 1. Finish A: Finish A shall be a grout clean finish in accordance with ACI 301, Section 10.3.2. Surfaces shall be lightly sandblasted prior to sacking. For interior areas not exposed to moisture or weather, water used in the mortar shall be mixed with a PVA bonding compound as recommended by the manufacturer. Unless otherwise specified, Finish A shall be provided for all surfaces exposed to view, both painted and unpainted.
 - 2. Finish B: Finish B shall be the same as Finish A, except that the final burlap rubbing may be omitted, providing the steel trowel scraping removes the loose buildup from the surface. Finish B shall be provided for waterproof and moisture-proof coated surfaces.
 - 3. Finish C: Finish C shall be a finish which has surface imperfections less than 3/8 inch in any dimension. Surface imperfections greater than 3/8 inch shall be repaired or removed and the affected areas neatly patched. Finish C or smoother shall be provided for interior surfaces of tanks and channels from 1 foot below minimum water surfaces and down and otherwise unfinished interior surfaces.
 - 4. Finish D: Unless otherwise specified, Finish D shall be the finish for surfaces not exposed to view in the finish work or by other construction, which may be left as they come from the forms, except that tie holes shall be plugged and defects greater than 1/2 inch in any dimension shall be repaired.

3.16 SLAB FINISHES

- A. General: Where finish is not specified, floor slabs shall receive steel troweling. Dry cement shall not be used on new concrete surfaces to absorb excess moisture. Edges shall be rounded to a radius of 1/2 inch. Joints shall be grooved to a radius and depth of 1/4 inch each.
- B. Float Finish: Float finish shall conform to ACI 301, Section 11.7.2. Floating shall be performed with a hand or power driven float. Floating of any one area shall be the minimum necessary to produce the finish specified. Floating shall compact and smooth the surface and close any cracks and checking of surfaces. Float finish shall be applied to surfaces of channel and tank bottom slabs and to footings.
- C. Steel Trowel Finish: Steel trowel finish shall conform to ACI 301, Section 11.7.3. Immediately after final troweling, the surface shall be cured and protected as specified in paragraphs 03 30 00 3.09. Steel trowel finish shall be provided on floors unless specified otherwise.
- D. Broomed Finish: Broomed finish shall conform to ACI 301, Section 11.7.4. Broomed finish shall be provided for walks, tops of walls, slabs on grade exposed to atmosphere, and where otherwise specified.

3.17 FIELD SAMPLING AND TESTING OF CONCRETE

- A. General: Field sampling and testing shall be performed by the independent testing laboratory specified in paragraph 03 30 00-1.02A. Samples of concrete shall be taken at random locations and at such times to represent the quality of the materials and work throughout the project. The

laboratory shall provide the necessary labor, materials and facilities for sampling, casting, handling and storing the concrete samples at the site of work. The minimum number of samples and tests are specified in paragraph 03 30 00 3.17C.

- B. Sampling: Concrete shall be sampled as follows and tested in accordance with paragraph 03 30 00 3.17 C. Samples of plastic concrete shall be obtained in accordance with ASTM C172. Samples for pumped concrete shall be taken at the hose discharge point. Samples for other concrete shall be taken at the hopper of transit mix truck.
- C. Testing
1. Strength Tests: The strengths specified for the design mix shall be verified by the testing laboratory during placement of the concrete. Verification shall be accomplished by testing standard cylinders of concrete samples taken at the job site.
 2. Standard cylinders shall represent the concrete placed in the forms. One set of three standard cylinders shall be cast for each 50 cubic yards, or fraction thereof, for concrete placed in structures, building slabs and footings, but at least three cylinders shall be taken from any one batch. Casting, handling and curing of cylinders shall be in accordance with ASTM C31. Additional cylinders shall be provided when an error in batching is suspected. For the first 24 hours after casting, the cylinders shall be kept moist in a storage box constructed and located so that its interior air temperature will be between 60 and 80 degrees F. At the end of 24 hours, the cylinders shall be transported to the testing laboratory.
 3. Testing of specimens for compressive strength shall be in accordance with ASTM C39. Tests shall be made at 7 and 28 days from time of casting. One test cylinder from each group of three shall be tested at the end of 7 days, and two shall be tested at the end of 28 days. Each strength test result shall be the average of the strengths of two test cylinders at 28 days, except that if one cylinder in a set of two shows evidence of low strength due to improper sampling, casting, handling or curing, the result of the remaining one cylinder shall be used.
 4. The average of any three consecutive 28 day strength test results of the cylinders representing each class of concrete shall be equal to or greater than the specified strength and not more than 10 percent of the strength test results shall have values less than the specified 28 day strength for the total job concrete. No individual strength test results shall be less than the specified strength by more than 500 pounds per square inch.
 5. Certified reports of the test results shall be provided directly to the Engineer. Test reports shall include sufficient information to identify the mix used, the stationing or location of the concrete placement, and the quantity placed. Slump and ambient temperature shall be noted.
 6. If the 28 day test results fall below the specified compressive strength for the class of concrete required for any portion of the work, adjustment in the proportions, water content, or both, shall be made as necessary at the Contractor's expense. Changes and adjustments shall be reported in writing to the Engineer.
 7. If compressive test results indicate concrete in place may not meet structural requirements, tests shall be made to determine if the structure or portion thereof is structurally sound. Tests may include, but not be limited to, cores in accordance with ASTM C42 and any other analyses or load tests acceptable to the Engineer. Costs of such tests shall be borne by the Contractor.
 8. Drying Shrinkage:
 - a. Prepare 5 drying shrinkage specimens in accordance with ASTM C157, except as modified in this section.

- b. Remove drying shrinkage specimens from molds at age of 23 hours within 1 hour after trial batching, then immediately place them in water at 73 degrees Fahrenheit within 3 degrees for at least 30 minutes and then measure specimens within 30 minutes thereafter to determine original length.
 - c. Then submerge specimens in saturated limewater at 73 degrees Fahrenheit within 3 degrees for moist curing.
 - d. Make measurement to determine expansion expressed as percentage of original length at age 7 days.
 - e. Use length at age 7 days as base length for drying shrinkage calculations.
 - f. Immediately store specimens in humidity controlled room maintained at 73 degrees Fahrenheit within 3 degrees and 50 percent within 4 percent relative humidity for remainder of test.
 - g. Make and report measurements to determine shrinkage expressed as percentage of base length separately for 7, 14, 21, and 28 days of drying after 7 days of moist curing.
 - h. Drying shrinkage deformation:
 - i. Measure drying shrinkage deformation of each specimen as difference between base length and length after drying at each test age.
 - j. Measure average drying shrinkage deformation of specimens to nearest 0.0001 inch at each test age.
 - k. If drying shrinkage of any specimen departs from average of test age by more than 0.0004 inch, disregard results obtained from that specimen and test another specimen.
 - l. Shrinkage of trial batch concrete at 28 days drying age shall not exceed 0.045 percent maximum.]
9. Trial Batch:
- a. If trial batch tests do not meet specified requirements for slump, strength, workability, consistency, drying shrinkage, and finishing, change concrete mix design proportions and, if necessary, source of aggregate.
 - b. Perform additional trial batches and tests until an acceptable trial batch is produced that meets requirements of this Section.
 - c. Perform test batches and tests required to establish trial batches and acceptability of materials without change in Contract Price.
 - d. Do not place concrete until the concrete mix design and trial batch have been accepted by Engineer.
 - e. Required average compressive strength:
 - f. Determine required average compressive strength (f'_{cr}) for selection of concrete proportions for mix design, for each class of concrete, using calculated standard deviation for its corresponding specified compressive strength (f'_c) in accordance with ACI 318 and ACI 350.
 - g. When test records of at least 30 consecutive tests that span period of not less than 45 calendar days are available, establish standard deviation as in accordance with ACI 318 and ACI 350 and as modified in this Section.
 - h. Provide test records from which to calculate standard deviation that represent materials, quality control procedures, and conditions similar to materials, quality

control procedures, and conditions expected to apply in preparation of concrete for the Work.

- i. Provide test records with materials and proportions that are more restricted than those for the Work.
- j. Specified compressive strength (f_c) of concrete used in test records: Within 1,000 pounds per square inch of that specified for the work.
- k. When lacking adequate test records for calculation of standard deviation meeting requirements, determine required average compressive strength f_{cr} from following:

l. REQUIRED AVERAGE COMPRESSION STRENGTH

- 1) Specified Compressive Strength f_c
 - a) Less than 3,000 $f_c + 1,000$
 - b) 3,000 to 5,000 $f_c + 1,200$
 - c) Over 5,000 $1.10f_c + 700$

D. Aggregate Testing:

- 1. Testing of concrete aggregate is at Contractor's expense.
- 2. Provide test reports representing samples of materials taken and tested at the following times:
- 3. Not more than 60 days prior to the date on the proposed materials for concrete mixes.
- 4. Not more than 60 days prior to any change in the source of aggregates, including suppliers and/or quarries.
- 5. Whenever there is a significant change in aggregate quality or gradation from a previously submitted and accepted source.
- 6. Sample aggregate in accordance with ASTM D75.
- 7. Fine and coarse aggregates:
- 8. Gradation: Test in accordance with ASTM C136. Use sieves with square openings for testing grading of aggregates.
- 9.

E. Tests for Consistency of Concrete: The slump shall be as specified when measured in accordance with ASTM C143. Samples for slump determination shall be taken from the concrete during placing. Slump tests shall be performed whenever standard cylinders are cast.

F. Final Laboratory Report: A final report, prepared by the testing laboratory, shall be provided at the completion of all concreting. This report shall summarize the findings concerning concrete used in the project and provide totals of concrete used by class and structure.

3.18 WATERTIGHTNESS, TESTING AND REPAIR:

A. Concrete tanks and channels which have walls or slabs that are subjected to hydrostatic pressure, shall be tested for watertightness. The tests shall be made prior to application of waterproofing coating. Testing shall consist of filling the tank with water to the maximum operating water surface for at least 24 hours. Wet spots, leakage, or seepage revealed by the test, including those caused by shrinkage of concrete, honeycombed areas, construction joints, or other sources shall be repaired by either or both of the following methods:

1. Grouting of the joint by drilling grout holes to the affected crack or honeycombed area, installing injection ports and forcing expansive urethane grout into the joint under pressure.
2. Cutting of a bevel groove on the water side of the joint. The groove shall be 1/2 to 3/4 inch in width and depth and shall be caulked with joint sealer in accordance with manufacturer's instructions.

3.19 CLEAN-UP

- A. Upon completion of the work and prior to final inspection, the Contractor shall clean all concrete surfaces, except outside sidewalks or paved areas and those having curing and sealing compound.

3.20 DEFECTIVE CONCRETE

- A. Any concrete which has spalls, honeycombs, cracks, or soft areas shall be removed and repaired. No repairs shall be made until the defects have been reviewed and method of repair approved by the Engineer.
- B. Remove all defective or damaged concrete, including honeycombed, sand streaked, or fractured material from the area to be repaired. Chip out areas to one inch minimum depth. Edge shall be squared with the surface to eliminate feather edges.
- C. Before placing the repair material obtain Engineer inspection. Clean area free of shipping dust, dried mortar, and all other foreign materials.
- D. Keep surfaces to be repaired continuously wet for at least three hours prior to placing new concrete or mortar. No free water on the surface when the repair material is placed.
- E. Apply a bonding agent to the area to be repaired before placing repair material. Apply the bonding agent per manufacturer's published instructions attached to container.

3.21 UNSATISFACTORY CONCRETE

- A. Any concrete placed which fails to meet or exceed the specified strength requirements as determined from molded cylinders or cores, or to meet the density or surface requirements, or which has been frozen during placing or curing, shall be removed and replaced with satisfactory materials at the Contractor's expense.
- B. Method of determining unsatisfactory concrete: visual appearance characteristic of rain or freeze damage to concrete which is apparent to the Engineer.

END OF SECTION

SECTION 05 52 00

GUARDRAILING AND HANDRAILING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section specifies prefabricated aluminum guardrailing and handrailing.
- B. Work of this section shall apply to all process related structures. Refer to Section 05 50 00 for railing and guardrail for non-process related civil site improvements.

1.02 QUALITY ASSURANCE

- A. General: Guardrailing and handrailing shall conform to the standards of the Occupational Safety and Health Administration (OSHA) and the International Building Code (IBC).
- B. References: This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A320/A320M	Alloy-Steel Bolting Materials for Low-Temperature Service
ASTM B241/ B241M	Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube

1.03 SUBMITTALS

- A. Comply with Section 01 33 00. Submit complete shop drawings showing materials, layout and connection details. Shop drawing shall be accompanied by a letter certifying that the drawings represent construction which conforms to OSHA and IBC standards.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Guardrailing and handrailing materials shall be as specified as follows:

<u>Material</u>	<u>Component</u>
Aluminum	ASTM B241, alloy 6061-T6 or 6063 T6
Bolts, nuts and washers	ASTM A320, Type 304

2.02 FABRICATION

- A. General
 - 1. Pipe cuts shall be clean, straight, square and accurate for minimum joint gap. Work shall be done in conformance with the guardrail manufacturer's instructions. Work shall be free from blemishes, defects, and misfits of any type which can affect durability, strength, or appearance.

2. Guardrailing and handrailing shall be connected by screws or bolts. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Wherever needed because of the thickness of the metal, holes shall be subpunched and reamed or drilled. Railing components with mismatched holes shall be replaced. No drifting of bolts nor enlargement of holes will be allowed to correct misalignment.

B. Aluminum Handrails

1. Aluminum guardrails and handrails shall be Wesrail as manufactured by Moultrie Manufacturing Company; Connectorail as manufactured by Julius Blum and Company, Inc.; C V Pipe rail as manufactured by Crane-Veyor Corporation; or equal modified to meet specified requirements.
2. Aluminum railing components shall have a clear satin anodized architectural Class I finish of minimum 0.7 mil thickness. Rails, posts, stanchions, and specials shall be fabricated from 1 1/2 inch diameter, Schedule 40 cylindrical sections.
3. Toeboards shall be provided where specified on the drawings. Toeboards shall be aluminum with a minimum thickness of 3/16 inch and shall be bolted to the vertical railing supports. Toeboards shall be designed to allow for thermal contraction and expansion.

PART 3 EXECUTION

3.01 GENERAL

- A. Guardrailing and handrailing shall be as specified and shown on the drawings. Measurements for railings shall be field verified before fabrication.
- B. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings, or isolators. Aluminum in contact with concrete or grout shall be protected with a heavy coat of bituminous paint.
- C. Metal to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed. Where required, recesses or blockouts shall be formed in the concrete, and the metalwork shall be grouted in place after concrete has attained its design strength in accordance with Section 03 30 00.

END OF SECTION

SECTION 05 53 00

METAL GRATING, FLOOR PLATES, AND COVER PLATES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This section specifies floor grating, floor plates, and cover plates.

1.02 REFERENCES

A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
AISC Manual of Steel Construction	American Institute of Steel Construction, Manual of Steel Construction, Allowable Stress Design-9th Edition
ASCE Journal Vol. 88 ST6-62	Suggested Specifications for Structures of Aluminum Alloys 6061 T6 and 6063 T6
ASTM A36/A36M	Structural Steel
ASTM A569/A569M	Steel, Sheet and Strip, Carbon, Hot Rolled, Commercial Quality
ASTM B210	Aluminum and Aluminum Alloy Drawn Seamless Tubes
ASTM B221	Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

PART 2 PRODUCTS

2.01 MATERIALS

A. Aluminum: Aluminum grating bearing bars and aluminum floor plates and cover plates shall be of alloy 6061 T6 conforming to ASTM B221. Aluminum grating cross bars shall be of an alloy conforming to either ASTM B221 (extrusions) or B210 (drawn).

B. Steel: Steel grating bearing bars and cross bars shall be of welding quality mild carbon steel conforming to ASTM A569. Steel floor plates and cover plates shall be of structural quality steel conforming to ASTM A36. All steel grating shall be hot-dip galvanized.

2.02 FABRICATION

A. General

1. Rough weld beads and sharp metal edges on gratings and plates shall be ground smooth. Welds exposed to view shall be uniform and neat. Welds to be galvanized shall be sandblasted prior to galvanizing.
2. Holes shall be punched 1/16 inch larger than the nominal size of the bolts, unless otherwise specified. Whenever needed, because of the thickness of the metal, holes

shall be sub-punched and reamed or shall be drilled. Cutting, drilling, punching, threading and tapping shall be performed prior to hot dip galvanizing.

B. Grating

1. General: Grating shall be as specified. Both bearing bars and cross bars shall be continuous. Openings shall be banded with bars having the same dimensions as the bearing bars. Perimeter edges shall be banded with bars flush at the top surface of the grating and 1/4 inch clear of the bottom surface. Bars terminating against edge bars shall be welded to the edge bars when welded construction is used. When crimped or swaged construction is used, bars at edges shall protrude a maximum of 1/16 inch and shall be peened or ground to a smooth surface. No single piece of grating shall weigh more than 80 pounds unless specifically detailed otherwise.
2. Aluminum Grating: Unless otherwise specified, grating shall be fabricated of aluminum. Bearing bars shall be punched to receive the cross bars. After insertion in the bearing bars, cross bars shall be deformed by a hydraulic press or similar means to permanently lock the bars into the bearing bar openings. Fabrication methods employing bending or notching of bearing or cross bars will not be permitted. Aluminum grating shall be Gary Galok, Seidelhuber, or equal.
3. Steel Grating: Steel grating shall be used only where specified or shown on the plan. Steel grating shall be hot dip galvanized. Notching, slotting, or cutting the top or bottom edges of bearing bars to receive cross bars will not be permitted unless each intersection of bars is fully welded to restore each bearing bar to its full cross-sectional strength.
4. Floor and Cover Plates: Floor and cover plates (Checkered Plate) shall be Alcoa C 102 aluminum tread plate, Reynolds diamond tread plate, or equal, unless specifically detailed otherwise. Hinged cover plates shall be as specified and shall be set flush with surrounding floor. No single piece of floor and cover plate shall weigh more than 80 pounds unless specifically detailed otherwise.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Fieldwork shall not be permitted on galvanized items. Drilling of bolts or enlargement of holes to correct misalignment will not be allowed.
2. Dissimilar metals shall be protected from galvanic corrosion by means of pressure tapes, coatings or isolators. Aluminum in contact with concrete shall be protected by a heavy coat of bituminous paint.
3. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if specified, recesses or blockouts shall be formed in the concrete after it has attained its design strength and the metalwork grouted in place as specified in Section 03 30 00. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned. If accepted, recesses may be neatly cored in the concrete.

- B. Grating, Floor and Cover Plates: Grating, floor and cover plates shall be field measured for proper cutouts and proper sizes. Field welding of aluminum grating and cover plates, where specified, shall be in accordance with ASCE Vol. 88 ST6.

3.02 CLEANING

- A. After installation, damaged surfaces of shop primed metals shall be cleaned and touched up with the same material used for the shop coat. Damaged surfaces of galvanized metals shall be repaired as specified in Section 05 91 00.

END OF SECTION

SECTION 11 00 00

GENERAL REQUIREMENTS FOR EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Scope: This section specifies general requirements applicable to all mechanical equipment specified in Divisions 40, 41, 43, 44, and 46. The Contractor is responsible for ensuring all mechanical equipment meets the requirements of this section in addition to the specific requirements of the individual equipment specification section. Where the requirements of this section are in conflict with the requirements of an individual equipment specification section, the individual equipment specification shall take precedence. The Contractor shall be responsible for coordinating the installation of the equipment.
- B. Equipment Lists: Equipment lists, presented in these specifications and as specified on the drawings, are included for the convenience of the Contractor and are not complete listings of all equipment, devices and material to be provided under this contract. The Contractor agrees to prepare his own material and equipment takeoff lists as necessary to meet the requirements of this project manual.

1.02 QUALITY ASSURANCE

- A. Arrangement: The arrangement of equipment shown on the Drawings is based upon information available to the Owner at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The Drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require revision to meet actual equipment installation requirements. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be altered to accommodate the equipment provided. No additional payment will be made for such revisions and alterations.
- B. References: This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ABMA Std 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA Std 11	Load Ratings and Fatigue Life for Roller Bearings
ANSI B1.1	Unified Inch Screw Threads
ANSI B1.20.1	Pipe Threads, General Purpose (Inch)
ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800
ANSI B18.2.1	Square and Hex Bolts and Screws (Inch Series)
ANSI B18.2.2	Square and Hex Nuts (Inch Series)

- C. Unit Responsibility: Where specified in individual equipment specification sections, the Contractor shall assign unit responsibility to, and obtain each system from, the supplier of the primary or driven equipment. The supplier shall provide all components of the system to enhance compatibility, ease of construction and efficient maintenance. The responsible manufacturer shall coordinate selection and design of all system components such that all equipment is compatible and operates properly to achieve the performance requirements specified. Assignment of unit

responsibility shall in no way relieve the Contractor of his responsibility to the Owner for performance of all systems as provided elsewhere in the Contract Documents.

- D. Warranty: All equipment and systems specified in Divisions 40, 41, 43, 44, and 46 shall be warranted against defects in materials and workmanship for a period beginning from date of purchase and extending through the correction period specified in Section C800 Supplementary Conditions of the Construction Contract. During the warranty period, the equipment will be repaired or replaced at no cost to the Owner.
- E. The equipment manufacturer shall coordinate with suppliers of related equipment specified elsewhere in the Contract Documents to ensure proper operation and interface between system components.

1.03 SUBMITTALS

- A. Provide the following submittals, as applicable, for each unique equipment item and unique set of performance requirements in accordance with Section 01 33 00. Items 1 through 10 listed below must be submitted, reviewed by the engineer, and accepted prior to shipping of equipment.
 - 1. Manufacturer's data including complete manufacturer model number, materials of construction, equipment configuration, details of installation, equipment weight, and equipment coatings.
 - 2. Dimensioned fabrication drawings showing the entire assembly. This shall include a materials list, sizes, piping connections, ASTM designations where appropriate, thicknesses, construction, and description of all major components.
 - 3. A copy of the Contract Document control diagrams and process and instrumentation diagrams, with addenda updates that apply to the equipment, marked to show specific changes necessary for the supplied equipment. If no changes are required, the Drawing(s) shall be marked "no changes required."
 - 4. A copy of the individual equipment specification section with addenda updates that apply to the equipment specification section, with each paragraph check marked to show specification compliance or marked to show deviations.
 - 5. Electrical data and control and wiring diagrams, including a bill of materials, elementary control diagrams, connection diagrams, dimensioned panel layout drawings, and manufacturer's catalog data for all system components.
 - 6. Pump performance or equipment headloss curves and data, marked to indicate the operating limits recommended for stable operation between which the equipment may be operated without surge, cavitation, or vibration. The performance curves shall indicate each condition point specified showing head, power, efficiency, and NPSH required on the ordinate plotted against capacity on the abscissa. The performance curves shall indicate performance over the entire operating range of the pump from shutoff to maximum capacity for full and reduced speeds.
 - 7. Certified factory test data as specified where required in the individual equipment specification. One pump of each type (if pumps are identical test only one), 15 horsepower and greater, shall be tested for performance at the factory to determine head vs. capacity, efficiencies, and kilowatt draw required for the points that are specified. All tests shall be run in accordance with the latest edition of the American Institute Standards. If any deviation from the testing is found the pump shall be rejected. Provide certification of factory tests verifying design requirements. Testing shall also include the following:
 - a. Hydrostatic test with data recorded.

- b. Hydraulic test with minimum of 5 readings between shutoff head and 25 percent above design capacity, recorded on data sheets as defined by the Hydraulic Institute, signed, dated and certified.
- c. Certified pump curves showing head/flow, bhp, efficiency, NPSH curves.
- d. Certification that the pump horsepower demand will not exceed the rated motor horsepower beyond the 1.2 service rating at any point on the curve.
- e. Impeller, motor rating and electrical connections shall be checked for compliance to specific requirements.
- f. Submersible Pumps shall include the following additional items:
 - 1) Motor and cable insulation test for moisture content of insulation defects.
 - 2) After submerged test run of 30 minutes under 6 feet of water, item f shall be re-tested.
- 8. Warranty information as specified in Paragraph 1.02.D and Section 01 33 00.
- 9. Equipment Record Form as specified in Section 01 33 00.
- 10. Motor Data Form as specified in Section 11 05 13.
- 11. Submit operation and maintenance manuals as specified in Section 01 78 23, accompanied by an O&M Manual Transmittal Form.
- 12. Proposed on-site testing and start-up procedures in step-by-step detail in accordance with Section 01 91 13. Submittal of all test reports.
- 13. Certificate of Installation, Inspection and Start-up Services form as specified in Section 01 91 13.
- 14. Manufacturer's Certification of Instructional Services form as specified in Section 01 79 00.

PART 2 PRODUCTS

2.01 FLANGES AND PIPE THREADS

- A. Flanges on equipment and appurtenances provided under this section shall conform in dimensions and drilling to ANSI B16.1, Class 125 for maximum normal operating pressures of 150 psi or ANSI B16.1, Class 250 for maximum normal operating pressures of 300 psi, unless otherwise specified. Pipe threads shall conform in dimension and limits of size to ANSI B1.1, coarse thread series, Class 2 fit.
- B. Threaded flanges shall have a standard taper pipe thread conforming to ANSI B1.20.1. Unless otherwise specified, flanges shall be flat faced.
- C. Flange assembly bolts shall be heavy pattern, hexagonal head, carbon steel machine bolts with heavy pattern, hot pressed, hexagonal nuts conforming to ANSI B18.2.1 and B18.2.2. Threads shall be Unified Screw Threads, Standard Coarse Thread Series, Class 2A and 2B, ANSI B1.1.

2.02 BEARINGS

- A. Unless otherwise specified, equipment bearings shall be oil or grease lubricated, ball or roller type, designed to withstand the stresses of the service specified. Each bearing shall be rated in accordance with the latest revisions of ABMA standards for Load Ratings and Fatigue Life for Ball and Roller Bearings. Unless otherwise specified, equipment bearings shall have a minimum L-10

rating life of 50,000 hours. The rating life shall be determined using the maximum equipment operating speed.

- B. Grease lubricated bearings, except those specified to be factory sealed and lubricated, shall be fitted with easily accessible grease supply, flush, drain and relief fittings. Extension tubes shall be used when necessary. Grease supply fittings shall be standard hydraulic alemite type.
- C. Oil lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 60 degrees C (140 degrees F) and shall be equipped with a filler pipe and an external level indicator gage.
- D. All bearings accessible to touch and located within 7 feet measured vertically from floor or working level or within 15 inches measured horizontally from stairways, ramps, fixed ladders or other access structures shall either incorporate bearing housings with sufficient cooling to maintain surface temperature at 65 degrees C (149 degrees F) or less for continuous operation at bearing rated load and a 50 degrees C ambient temperature or appropriate shielding shall be provided that will prevent inadvertent human contact.

2.03 V-BELT ASSEMBLIES

- A. Unless otherwise specified, V-belt assemblies shall be Dodge Dyna-V belts with matching Dyna-V sheaves and Dodge Taper-lock bushings, Wood's Ultra V-belts with matching Ultra-V sheaves and Wood's Sure-Grip bushings, or equal.
- B. Sheaves and bushings shall be statically balanced. Additionally, sheaves and bushings which operate at a peripheral speed of more than 5500 feet per minute shall be dynamically balanced. Sheaves shall be separately mounted on their bushings by means of three pull-up grub or cap tightening screws. Bushings shall be key seated to the drive shaft.
- C. Belts shall be selected for not less than 150 percent of rated driver horsepower and, where two sheaves sizes are specified shall be capable of operating with either set of sheaves. Belts shall be of the antistatic type where explosion-proof equipment is specified.

2.04 PUMP SHAFT SEALS

- A. General: Where mechanical seals are specified, seals shall be self-contained cartridge type single or double mechanical seals as specified in individual equipment sections. Unless specified otherwise, mechanical seals shall conform to the requirements set forth in this paragraph.
- B. Mechanical Seals
 - 1. SINGLE CARTRIDGE SEAL: balanced o-ring, multi-spring design with self-aligning faces, one piece investment cast gland with flush, quench and drain ports, 316 SS construction, carbon vs. silicon carbide faces, carbon restriction bushing in atmospheric side of gland. Single mechanical seals shall be AESSEAL SCUSI or CURC as recommended by the manufacturer on a pump by pump basis; seals by other manufacturers will not be accepted.
 - 2. DOUBLE CARTRIDGE SEAL: double balanced o-ring, multi-spring design with self-aligning faces inboard and outboard, one-piece investment cast gland, connection built-in to gland for inlet and outlet of barrier fluid, carbon vs. silicon carbide inboard faces, carbon vs. chrome oxide outboard faces. Double mechanical seals shall be AESSEAL CDSA; seals by other manufacturers will not be accepted.

3. Pumps used for hazardous chemicals and or abrasive fluids shall be equipped with double mechanical seals with built-in barrier fluid ports unless otherwise specified or requested by Owner.
4. For submersible pumps use AESSEAL T05 component seal or manufacturers equivalent, double mechanical seals for abrasives and single mechanical seals for clean water.

C. Shaft Packing

1. Where shaft packing is specified, stuffing boxes shall be tapped to permit introduction of seal liquid and shall hold a minimum of five rows of packing. Stuffing boxes shall be face attached. Stuffing box and shaft shall be suitable for field installation, without machining or other modifications, of the mechanical seal specified in subparagraph 2.04.B for the applicable pump and operating conditions.
2. Unless otherwise specified, lantern rings shall be bronze or Teflon, packing shall be die-molded packing rings of non-asbestos material suitable for the intended service and as recommended by the manufacturer, and glands shall be bronze, two piece split construction. Lantern rings shall be of two-piece construction and shall be provided with tapped holes to facilitate removal. Lantern rings shall be drilled and tapped 1/4 NC-20. Threaded lantern ring removal tools shall be provided with spare parts for each pump.

D. Seal Water Regulating and Monitoring System

1. Seal water monitoring system shall be a complete unified component capable of controlling all necessary aspects of the seal water system for pumps or equipment utilizing a packing gland type, single mechanical type, or double mechanical type shaft seal. Complete monitoring system shall include the single component control unit, mounting stand or bracket and associated hardware, and all necessary hoses, quick couplings, check valves, hose nipples, and hose couplings required for a complete and functioning system.
2. The base of the control unit shall be constructed of 7/8" thick, 316 stainless steel to accommodate fittings. Seal connections shall be 1/4" NPT for shaft sizes up to 2" diameter and pumped fluid temperature < 120 deg F. For shafts > 2" diameter or pumped fluid temperatures > 120 deg F, unit shall have min. 3/8" connections. Unit shall include a push button test and clean system for the flow meter which can be activated while unit is in operation. Unit shall utilize orifice shaped valves to allow larger particles of dirt and debris to pass through without stopping the flow or plugging the unit. Pressure gauge shall be glycerin filled. Unit shall come equipped with an inductive low-flow alarm sensor that utilizes an AC signal (20-250 VAC) to communicate to the process control system.
3. Complete seal water monitoring system as specified shall be John Crane Safeunit Model SFP or SFD, or approved equal. Unit shall be provided with connections as follows or per manufacturer's written instructions:
 - a. Packing gland or single seal flush type seal water system
 - 1) John Crane Safeunit Model SFP
 - 2) 1 connection – service water supply to unit
 - 3) 1 connection – seal water supply from unit to the shaft seal
 - b. Double mechanical type seal water system
 - 1) John Crane Safeunit Model SFD
 - 2) 1 connection – service water supply to unit

- 3) 1 connection – seal water supply from unit to shaft seal
- 4) 1 connection – seal water return from shaft seal to unit
- 5) 1 connection – drain line from unit

2.05 COUPLINGS

- A. Unless otherwise specified in the particular equipment sections, equipment with a driver greater than 1/2 HP, and where the input shaft of a driven unit is directly connected to the output shaft of the driver, shall have its two shafts connected by a flexible coupling which can accommodate angular misalignment, parallel misalignment and end float, and which cushions shock loads and dampens torsional vibrations. The flexible member shall consist of a tire with synthetic tension members bonded together in rubber. The flexible member shall be attached to flanges by means of clamping rings and cap screws, and the flanges shall be attached to the stub shaft by means of taperlock bushings which shall give the equivalent of a shrunk-on fit. There shall be no metal-to-metal contact between the driver and the driven unit. Each coupling shall be sized and provided as recommended by the coupling manufacturer for the specific application, considering horsepower, speed of rotation, and type of service.
- B. Where torque or horsepower capacities of couplings of the foregoing type is exceeded, Thomas-Rex, Falk Steel Flex, or approved equal couplings will be acceptable provided they are sized in accordance with the equipment manufacturer's recommendations and sizing data are submitted. They shall be installed in conformance to the coupling manufacturer's instructions.

2.06 GUARDS

- A. Exposed moving parts shall be provided with guards which meet the requirements of OSHA. Guards shall be fabricated of 14-gage steel, 1/2-13-15 expanded metal screen to provide visual inspection of moving parts without removal of the guard. Guards shall be galvanized after fabrication and shall be designed to be readily removable to facilitate maintenance of moving parts. Reinforced holes shall be provided. Lube fittings shall be extended through guards.

2.07 CAUTION SIGNS

- A. Equipment with guarded moving parts which operates automatically or by remote control shall be identified by signs reading "CAUTION - AUTOMATIC EQUIPMENT MAY START AT ANY TIME". Signs shall be as specified in Section 10 14 00. Signs shall be installed near guarded moving parts.

2.08 GAGE TAPS, TEST PLUGS, AND GAGES

- A. Gage taps shall be provided on the suction and discharge sides of pumps, blowers, compressors, and as shown in the Drawings. Pressure and vacuum gages shall be provided where specified.

2.09 NAMEPLATES

- A. A manufacturer's nameplate shall be provided for each piece of equipment and shall identify the manufacturer's name and address, and the specific style and/or model of the equipment provided.
- B. Project identification nameplates shall be provided on each item of equipment and shall contain the specified equipment name or abbreviation and equipment number. Equipment nameplates shall be engraved or stamped stainless steel and fastened to the equipment in an accessible location with stainless steel screws or drive pins.

- C. Project identification nameplates for pumps shall indicate rated head and flow, pump operating speed (rpm), and impeller diameter.

2.10 LUBRICANTS

- A. The Contractor shall provide for each item of mechanical equipment a supply of the lubricant required for the commissioning period. Lubricants shall be of the type recommended by the equipment manufacturer and shall be products of the Owner's current lubricant supplier. The Contractor shall limit the various types of lubricants by consolidating them, with the equipment manufacturer's approval, into the least number of different types. Not less than 90 days before the date shown in his construction schedule for starting, testing and adjusting equipment, the Contractor shall provide the Owner with three copies of a list showing the required lubricants, after consolidation, for each item of mechanical equipment. The list shall show estimated quantity of lubricant needed for a full year's operation, assuming the equipment will be operating continuously.

2.11 ANCHOR BOLTS

- A. Anchor bolts shall be designed for lateral forces for both pullout and shear. Anchor bolts shall be 304 stainless steel and comply with the requirements of Section 05 05 19.

2.12 SPARE PARTS

- A. Spare parts, wherever required by detailed specification sections, shall be stored in accordance with the provisions of this paragraph. Spare parts shall be tagged by project equipment number and identified as to part number, equipment manufacturer, and subassembly component (if appropriate). Spare parts subject to deterioration such as ferrous metal items and electrical components shall be properly protected by lubricants or desiccants and encapsulated in hermetically sealed plastic wrapping. Spare parts with individual weights less than 50 pounds and dimensions less than 2 feet wide, or 18 inches high, or 3 feet in length shall be stored in a suitable box, identified with stenciled lettering stating the name of the equipment, equipment numbers, and the words "spare parts." A neatly typed inventory of spare parts shall be taped to the exterior of the box.

PART 3 EXECUTION

3.01 GENERAL

- A. The manufacturer shall assume responsibility for packaging to prevent transit and handling damage.
- B. Store, install, and start-up each specified equipment system, including accessories, where shown on the Drawings, as specified herein, and as recommended by the equipment manufacturer's written instructions. Bring any discrepancies immediately to the attention of the Engineer.
- C. Final coatings, where required, shall be in accordance with Section 09 90 00.

3.02 INSTALLATION AND FIELD TESTING

- A. All certification of factory tests and materials shall be submitted and approved by the Engineer before shipping equipment.
- B. The Contractor shall install the equipment and make any and all necessary modifications and/or adjustments required to obtain satisfactory operation. Accurately place anchor bolts for skid

attachment to floor using dimensions as per the manufacturer installation data and as specified in Section 05 05 19.

- C. Provide lubrication and lubrication fittings before operating as per manufacturer's recommendations. Extend fitting to allow easy access and without having to remove covers or guards.
- D. Provide factory certified service technician to inspect the installation, unless otherwise specified.
- E. All equipment shall be field tested after installation in accordance with Section 01 91 13, the Contract Documents, the requirements of this section, and the requirements of the individual equipment specification to demonstrate satisfactory operation and performance, without causing excessive noise, cavitation, vibration, leakage, overheating, or other operational deficiencies. Field testing shall be performed under the supervision of an experienced field representative of the manufacturer, who shall supervise the testing and shall certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.
- F. Start-up: Start-up, check and operate equipment over the entire operational range and speed range.
- G. Pump systems. Pumps systems shall be tested for compliance with the following:
 - 1. Vibration shall be within amplitude limits recommended in the Hydraulic Institute Standards and shall be recorded at a minimum of four pumping conditions defined by the engineer.
 - 2. Pump performance shall be documented by obtaining concurrent readings, showing motor voltage, amperage, pump suction head, and pump discharge head for at least 4 pumping conditions. Each power lead to the motor shall be checked for proper current balance. All instrumentation necessary to conduct the testing shall be provided by the Contractor.
- H. The installation and initial operation of all components shall be certified on the Certificate of Installation, Inspection and Start-up Services form as specified in Section 01 91 13.
- I. Electrical and controls testing shall conform to the requirements of Section 01 91 13 and Divisions 26 and 40.

3.03 TRAINING

- A. Unless otherwise specified, training addressing the theory of operation, testing, troubleshooting, and maintenance of equipment item and system shall be provided. Training shall be conducted in accordance with Section 01 79 00 and shall be certified on Manufacturer's Certificate of Instructional Services in Section 01 79 00. Minimum training duration shall be as specified in the individual equipment specification.

END OF SECTION

SECTION 11 05 13

ELECTRIC MOTORS

PART 1 GENERAL

1.01 DESCRIPTION

- A. This section specifies low-voltage alternating current induction motors, 250 horsepower or less. This section does not specify medium voltage (over 600 volts) motors and specialty motors such as submersible motors, hoist motors, valve operator motors or torque rated motors. Unless specified otherwise, electric motors shall be provided by the manufacturer of the driven equipment under the provisions of Section 11 00 00. Unless specified otherwise in the particular equipment specifications, motors shall be provided in compliance with this specification Section.

1.02 QUALITY ASSURANCE

- A. General: Motors shall be built in accordance with UL 674, UL 1004, NEMA Standard MG 1, and to the requirements specified.
- B. References: This section contains references to the following documents. They are a part of this section as specified and modified. In the event conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ABMA 9	Load Ratings and Fatigue Life for Ball Bearings
ABMA 11	Load Ratings and Fatigue Life for Roller Bearings
IEEE 112	Standard Test Procedures for Polyphase Induction Motors and Generators
IEEE 841	Standard for Petroleum and Chemical Industry – Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors – Up to and Including 500 HP
NEMA ICS 2	Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA MG 1	Motors and Generators
UL 674	Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations
UL 1004	Standard for Rotating Electrical Machines – General Requirements

- C. Factory Testing: Motors rated 100 horsepower and greater shall be assembled and performance tested at the factory. Test results shall be submitted with the equipment operation and maintenance data. Factory tests shall include the following:
1. No load current.
 2. Full load current.
 3. Breakdown torque.
 4. Locked rotor current.

5. Locked rotor torque.
6. Hi-potential test.

1.03 AMBIENT CONDITIONS

- A. Motors shall be rated for continuous operation at nameplate horsepower under the following conditions:
1. Temperature (max): 50 degrees Centigrade
 2. Elevation: 6,400 feet above sea level.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. The following manufacturer's motors generally meet the class and performance requirements of this specification when furnished with appropriate modifications and additional features as specified:
1. Baldor
 2. General Electric
 3. Reliance Electric Co.
 4. US Motor

2.02 GENERAL

- A. Nameplates: Motor nameplates shall be engraved or stamped stainless steel or brass. Information shall include those items enumerated in NEMA Standard MG 1, paragraph 10.37, 10.38 or 20.60, as applicable. Nameplates shall be permanently fastened to the motor frame and shall be positioned to be easily visible for inspection.
1. Additional Markings:
 - a. Nameplates for motors 1/2 horsepower and larger shall indicate the ABMA L-10 rated life for the motor bearings.
 - b. Nameplates for motors 2 horsepower and larger shall list the NEMA nominal efficiency.
 - c. Nameplates for inverter duty motors shall identify the motor as inverter duty.
 - d. Nameplates for IEEE 841 compliant motors shall indicate IEEE 841 compliance.
 - e. Nameplates for explosion proof motors shall also indicate UL frame temperature limit code.
- B. Construction: All motors provided under this specification shall have the following features of construction unless otherwise specified:
1. Cast iron frames for motors 1/2 horsepower and larger. Steel frames for motors smaller than 1/2 horsepower. Aluminum frame motors will not be permitted.
 2. Cast metal fan blades and shrouds.
 3. Cadmium plated hardware.

4. Non-hygroscopic leads.
5. Class B temperature rise above 40 degrees C ambient.
6. NEMA design B.
7. NEMA F1 mounting configuration.

C. Provide the below listed information:

1. Completed motor data form (Form 11 05 13, appended to the end of this section).
2. Detail drawings including:
 - a. Motor outline, dimensions, and weight.
 - b. Motor connection diagram indicating requirements for all electrical connections.
3. Manufacturer's descriptive information relative to motor features and conformance with specified standards.

2.03 MOTORS LESS THAN 1/2 HORSEPOWER

- A. General: Unless otherwise noted on the Drawings or Specifications, motors less than 1/2 horsepower shall be squirrel cage, single phase, capacitor start, induction run type. Construction features listed in paragraph 11 05 13-2.02 may be as normally supplied by the equipment manufacturer. Single phase motors shall have Class B insulation. Small fan motors may be split-phase or shaded-pole type. Windings shall be copper.
- B. Rating: Motors shall be rated 115 volts, single phase, 60 hertz, and shall be continuous time rated in conformance with NEMA Standard MG 1, paragraph 10.35. Motors shall be non-overloading at all points of the equipment operation.
- C. Enclosures: Motor enclosures shall be as defined in NEMA MG 1. Unless otherwise specified, motors shall have totally enclosed fan cooled or totally enclosed non-ventilated enclosures. Explosionproof motors shall bear the UL Label for Class I, Division 1, Group D hazardous locations.

2.04 MOTORS 1/2 HORSEPOWER THROUGH 250 HORSEPOWER

- A. General: Motors 1/2 horsepower through 250 horsepower shall be three phase, squirrel cage, full voltage start induction type. Unless otherwise specified, motors shall have a NEMA MG 1-1.16 design for the duty service imposed by the driven equipment such as frequent starting, intermittent overload, high inertia, mounting configuration, or service environment.
- B. Rating: Motors shall be rated 460 volts, three phase, 60 Hz, and shall be continuous time rated in accordance with NEMA Standard MG 1, paragraph 10.35. Unless specified otherwise, motors shall have a service factor of 1.15, but shall not be required to exceed their nameplate rating at any point in the service range of the driven equipment.
- C. Efficiency: Motors shall be premium energy efficient type. Motor minimum nameplate efficiency, determined in accordance with IEEE 112B testing procedures, when operating on a sinusoidal power source shall be as specified in NEMA MG1 for premium efficiency electric motors.
- D. Classifications
 1. General: Motors shall conform to the requirements specified in the following paragraphs. Definition of terms shall be in accordance with NEMA MG 1. Temperature rise for all motor types shall not exceed that permitted by Note II, paragraph 12.42, NEMA MG 1.

2. Type 1 Motors: Type 1 motors shall have drip-proof guarded enclosures with Class F insulation and Class B temperature rise at the motor's nominal rating.
 3. Type 2 Motors: Type 2 motors shall be totally enclosed, fan-cooled with Class F insulation and Class B temperature rise at the motor's nominal rating.
 4. Type 2S Motors: Type 2S motors shall be totally enclosed, fan-cooled designed for severe duty applications. Type 2S motors shall conform to the requirements of IEEE 841. Motor nameplate shall indicate IEEE 841 compliance.
 5. Type 3 Motors: Type 3 motors shall be explosionproof motors, UL listed in accordance with UL 674 for Class I, Group D hazardous atmospheres. The motor shall have Class F insulation and shall conform to IEEE 841. An UL-approved breather/drain device shall be provided in the motor drain hole.
- E. Thermal Protection: Type 2 and Type 3 motors, 50 horsepower and larger, shall be provided with Type 1 thermal protection as defined in NEMA MG 1-12.53.1 unless otherwise specified. Motor manufacturer shall provide any auxiliary equipment required to monitor the thermal protection devices. Auxiliary equipment shall have normally closed NEMA ICS 2 B300 contacts and shall be housed in NEMA 250 enclosures as follows:
1. Type 2 Motors: NEMA 4
 2. Type 3 Motors: NEMA 7D
- F. Inverter Duty Motors: Motors specified as inverter duty in the process equipment specifications shall have the features of the specified motor classification (Refer to paragraph 11 05 13-2.04 D) in addition to the features specified herein for inverter duty motors.
1. Motors intended for use with adjustable frequency controllers shall not exceed NEMA MG 1, Class B, temperature rise when operating over the specified speed range with the specified load speed/torque characteristic. Inverter duty motors may be NEMA MG1-1.16, Design A.
 2. Motors intended for use with adjustable frequency controllers shall be inverter duty motors specifically designed for inverter service for the speed range and load torque characteristic required by the associated driven equipment. Inverter duty motor shall be designed to operate over the speed or frequency range specified. Motor insulation shall be designed to meet NEMA MG 1, Part 31 (1600 volt peak at a minimum of 0.1 micro-second rise time).
 3. Motors shall be premium energy efficient type with a minimum nameplate efficiency as specified in paragraph 11 05 13-2.04 C at rated load on sine wave power at the base voltage and frequency rating. Motors shall have a 1.15 service factor on sine wave power at the base voltage and frequency rating and a 1.0 service factor on inverter power throughout the specified speed range.
 - a. Shaft Grounding Unit: Where specified, inverter duty motors shall be equipped with a shaft grounding unit mounted on the fan housing with stub shaft extended from the motor shaft. Grounding unit shall be equipped with two brushes, totally enclosed and sealed against environmental contamination.
 - b. Winding Overtemperature Protection: All inverter duty motors shall be provided with stator winding overtemperature protection. Overtemperature protection shall be NEMA MG 1-12.53, Type 1 winding and locked rotor overtemperature protection. Detectors shall be positive thermal protection (PTC) thermistors with leads brought out to a terminal block in an auxiliary conduit box integral to the motor. Thermistor characteristics shall comply with IEC 60034-11-2. Two thermistors shall be provided in each phase of the stator winding. All thermistor

leads (2 per thermistor) shall be labeled and terminated in the motor auxiliary conduit box.

- c. Blower-Cooled Motors: Where specified, or required by the specified application requirements, inverter duty motors shall be totally enclosed, air-over, blower-cooled (TEBC). Blowers shall be driven at constant speed by 460-volt, 3-phase motors in conformance with Type 2 requirements as specified in paragraph 11 05 13-2.04 D. Blower and ducting shall be an integral part of the main motor frame. Air intake filter shall be provided. Scroll case shall be cast aluminum or iron, and fan wheel shall be Type 304 stainless steel.

- G. Vertical Motors: Vertical motors shall be solid-shaft P-base type specifically designed for vertical installation. Universal position motors are not acceptable. Vertical motors shall conform to Type 2, Type 3, and/or inverter duty motor requirements as specified. Thrust bearing rating shall be compatible with the loads imposed by the driven equipment.

- H. Conduit Boxes: Conduit boxes shall be cast iron, split construction with threaded hubs. Conduit boxes shall be sized at least one size larger than NEMA standard for the given motor size. Conduit boxes shall be designed to rotate in order to permit installation in any of four positions 90 degrees apart. Motors shall be furnished with petroleum-resistant gaskets at the base of the conduit box and between the halves of the conduit box. Motors shall have grounding lug located within the box for the ground connection. Minimum length of pigtail leads shall be 12 inches for motors up to 50 horsepower, and 16 inches for motors larger than 50 to 250 horsepower.
 - 1. A separate, auxiliary conduit box shall be provided for terminating the leads of internal motor accessories including thermal protective devices, space heaters, etc.

- I. Bearings: Bearings may be oil or grease lubricated ball or angle contact roller bearings rated for a minimum L-10 life of 100,000 hours in accordance with ABMA 9-1990 or ABMA 11-1990 at the ambient temperature specified. Motor designs employing cartridge type bearings will not be accepted. Bearings shall be fitted with lubricant fill and drain or relief fittings.

- J. Lifting Eyes: Motors weighing more than 50 pounds shall be fitted with at least one lifting eye.

- K. Current Imbalance: Current imbalance, based upon the lowest value measured, shall not exceed the values tabulated below when the motor is operating at any load within its service factor rating and is supplied by a balanced voltage system:
 - 1. Under 5 horsepower: 25 percent
 - 2. 5 horsepower and above: 10 percent

- L. Space Heaters: Where specified, space heaters shall be sized and designed to prevent condensation inside the motor enclosure after shutdown. Heaters shall be cartridge or flexible wraparound type. Heaters shall be rated 120 volts, single phase, 60 Hz. The space heater rating in watts and volts shall be noted on the motor nameplate or on a second nameplate. Space heater terminals shall be brought to a separate terminal block or pigtails in the conduit box.

- M. For motors 100 horsepower and larger, a motor heating curve.

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which motors are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 INSTALLATION OF MOTORS

- A. Install motors and accessories in accordance with manufacturer's instructions. Manufacturer's installation instructions shall be available at the project site.
- B. Remove any slushing compound on shaft or other parts using a petroleum-type solvent.
- C. Remove shaft shipping braces after motor is placed in its final location.
- D. Install motor securely on firm, level foundation.
- E. Install shaft coupling or sheave in accordance with manufacturer's instructions. Do not modify motor shaft to accommodate coupling or sheave.
- F. Align the motor shaft with the load shaft. Meet the most stringent of the motor manufacturer's requirements for shaft alignment or the driven equipment manufacturer's requirements for shaft alignment.
- G. Verify that line voltage and phases agree with motor nameplate.
- H. Ground motors according to manufacturer's instructions and the requirements of Specification 33 71 02.
- I. Make electrical connections to motors using materials and methods in accordance with Specification 26 20 00. Use motor lead splicing kits to insulate and seal connections to leads.

3.03 FIELD INSPECTION AND TESTING

- A. Verify that motor is lubricated in accordance with manufacturer's instructions.
- B. Before energizing, turn motor shaft by hand to ensure free rotation.
- C. Verify that the area around motor fan cooling air inlets is free of debris that could be drawn into motor or motor fan during operation.
- D. Check external bolted connections for proper torque.
- E. Before energizing motor with driven equipment, verify proper alignment of motor shaft with load shaft. Provide alignment test report.
- F. Inspect and test motor installations in accordance with the requirements of Specification 26 08 00.

END OF SECTION

Form 11 05 13
Motor Data Form

Driven Equipment Name: _____ Equipment Numbers: _____
 Driven Equipment Description: _____
 Driven Equipment Location: _____

Motor Nameplate Markings

Manufacturer: _____ Manufacturer Type: _____
 Frame: _____ Horsepower: _____ Service Factor: _____
 Volts: _____ Phase: _____ Temperature Rating: _____ °C
 Full Load Amps: _____ Frequency: _____ Locked Rotor Amps: _____
 Design Letter: _____ Code Letter: _____ Insulation Class: _____
 RPM: _____ Time Rating: _____

Motor Efficiency

Motor Enclosure Type

Guaranteed minimum efficiency: _____ Open drip proof _____
 Nameplate or nominal efficiency: _____ Totally enclosed, fan-cooled _____
 _____ Explosion proof (Class I, Division 1) _____
 _____ Other: _____

Motor Construction Features

YES	NO

Inverter Duty (NEMA MG 1, Part 31): _____
 Winding Overtemperature Protection (PTC Thermistors in each winding): _____
 Cast Iron Frame: _____
 IEEE 841 Compliant _____
 NEMA Mounting Configuration: _____
 Bearing Life (Hours): _____

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. General: This section specifies several categories of provisions for electrical work, including:
 - 1. Certain adaptive expansions of requirements specified in the General Conditions.
 - 2. General performance requirements within the electrical system as a whole.
 - 3. General work to be performed as electrical work, because of its close association.
- B. Drawings: Examine all drawings relating to the project. Include all work, materials, and equipment mentioned or shown as being provided under this division. Refer to all Drawings and details in coordinating and completing the work. Study all Drawings to determine any conflicts with ordinances and statutes. Report any discrepancies, conflicts, or omissions; accomplish work required for conformance and/or completion.
- C. Specifications: Examine all specification divisions relating to the project. Include all work, materials, and equipment mentioned as being provided under this division. Study all specifications to determine any conflicts with ordinances and statutes. Report any discrepancies, conflicts, or omissions; accomplish work required for conformance and/or completion.
- D. General Outline: The facilities and systems of the electrical work can be described (but not by way of limitation) as follows:
 - 1. Coordination and installation of new electrical equipment to the existing electrical distribution.
 - 2. Lighting systems.
 - 3. Controls and instrumentation systems as indicated.

1.02 RELATED SECTIONS

- A. General Conditions – Coordination and Meetings
- B. General Conditions – Submittals

1.03 REFERENCES

- A. ANSI – American National Standards Institute
- B. ASTM – American Society of Testing Materials
- C. IEEE – Institute of Electrical and Electronic Engineers
- D. ICEA – Insulated Cable Engineers Association
- E. NECA – National Electrical Contractors Association
- F. NFPA 70 – National Electric Code (NEC)

G. OSHA – Occupational Safety and Health Act

H. UL – Underwriters' Laboratories

1.04 ACTION SUBMITTALS

A. General: Electrical compliance submittals shall be prepared and submitted in accordance with the Conditions of Contract, General Conditions, and this specification section. The types of submittals required for electrical work are defined herein. Refer to each Division 26 specification section for detailed requirements for submittal content. Administrative submittals are specified elsewhere in the Contract Documents.

B. Content: Electrical compliance submittals shall include the following information.

1. Each specification section shall be submitted separately for approval. All equipment included in the submittal shall be listed. Combined section submittals are not acceptable.
2. Shop Drawings: Project shop drawings and other data prepared specifically for fulfillment of the project requirements. Shop drawings include fabrication, physical size, dimensioned layout, wiring diagrams, coordination and similar drawings and diagrams, and include performance data associated therewith, including weights, capacities, speeds, outputs, consumptions, efficiencies, voltages, amperages, cycles, phases, noise levels, operating ranges, and similar information.
3. Manufacturer's Data: Manufacturer's most current standard printed product information, including (as applicable) promotional brochures, product specifications, installation instructions and diagrams, statements of compliance with standards, performance charts or curves, and similar information concerning the standard portions of the manufacturer's products.
4. Certifications: Written statements, either standard printed forms or specifically prepared text, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying (to the best of his knowledge) to compliance with the requirements as specified.
5. Specification Conformance: Each electrical submittal shall include a copy of the applicable specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (in the margin adjacent to the beginning of the paragraph) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

C. Submittal Presentation: Submittal data shall be assembled in a PDF document. Each PDF submittal shall contain a cover sheet, bookmarked by item, and cross-referenced to the appropriate specification paragraph. Catalog cuts shall be edited and clearly identify only the items, model numbers, and information that applies to the equipment being furnished.

D. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for re-submittal.

1.05 INFORMATION SUBMITTALS

A. Instruction Manuals

1. General: Submittals shall be in accordance with Conditions of Contract, General Conditions, and the requirements of this specification section. Instruction Manuals shall be submitted complete prior to commencing any training; partial or incomplete data shall not be accepted.
2. Electronic Copy: One (1) electronic copy of all Instruction Manuals shall be provided in portable document format (.PDF) with each section identified and bookmarked by item.
3. Content: Instruction Manuals shall include the following information.
 - a. Contact Information: Instruction Manuals shall include the names, addresses, and telephone numbers of the manufacturer, the nearest representative of the manufacturer, and the nearest supplier of the manufacturer's equipment and parts.
 - b. Manufacturer's Product Warranties: Manufacturer's standard printed commitment in reference to a specific product and normal application, stating that certain acts of restitution will be performed for the Purchaser or Owner by the manufacturer, when and if the product fails within certain operational conditions and time limits.
 - c. User Manuals: The written instructions by the manufacturer, fabricator, or installer of equipment or systems, detailing the procedures to be followed by the Owner in configuration, operation, control, and shutdown of each operating item of the equipment and each electrical system.
 - d. Maintenance Manuals: The compiled information provided for the Owner's maintenance and troubleshooting of each system of operating equipment, including lubrication, emergency control, parts replacement, spare parts inventory recommendation, listing of tools and accessories needed for maintenance, and similar instructions.
 - e. Guarantees: The Contractor's specific signed commitment (sometimes requiring also that other countersign) to the Owner that certain acts of restitution will be performed when and if certain portions of electrical work fail within certain operational conditions and time limits.
 - f. Certifications: Written statements, either standard printed forms or specifically prepared text, executed specifically for the project application by an authorized officer of the contracting firm, manufacturer, or other firm as designated, certifying (to the best of his knowledge) the equipment installation, configuration, and startup is in compliance with the manufacturer's recommendations and the project requirements.
 - g. Test Reports: The results of all specified factory and field tests shall be included with the Instruction Manuals.
 - h. Startup Reports: Equipment manufacturer's field startup reports shall be included with the Instruction Manuals.
 - i. Configuration Data: A written record documenting the setup and configuration of each system that is software, hardware, or firmware configurable in the field shall be included in the Instruction Manual. All configuration parameters, jumpers, switch settings, etc., shall be recorded.
 - j. As-Built Control Wiring Diagrams and Assembly Drawings: As-built control diagrams and assembly drawings shall be provided in appropriately sized

binders. Drawings shall not be reduced in size for assembly in the instruction manual. As-built drawings shall be organized by facility or location.

B. Drawings

1. Where the Contractor is required to provide information on drawings as part of the specified work, such drawings shall be prepared on 11 inch by 17 inch paper complete with borders and title blocks clearly identifying project name, equipment and the scope of the drawing. Drawings shall be prepared on a computer-aided drafting (CAD) system. All CAD drawing files shall be converted to .DWG file format and electronically submitted. All CAD drawing files shall be updated to reflect final as-constructed conditions.

1.06 QUALITY ASSURANCE

A. General: Refer to the General Conditions for general administrative/procedural requirements related to compliance with codes and standards. Materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards, and utility company regulations. In case of difference between codes, state laws, local ordinances, industry standards, utility company regulations, and the contract documents, the most stringent shall govern.

B. Definitions

1. Elementary or Schematic Diagram: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.
2. One-line Diagram: A one-line diagram shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.
3. Block Diagram: A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.
4. Wiring or Connection Diagram: A wiring or connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly.
5. Interconnection Diagram: Interconnection diagrams shall show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams that interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable. Wire identification shall be shown as actually installed. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification.
6. Arrangement, Layout, or Outline Drawings: An arrangement, layout, or outline drawing is one that shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

- C. Identification of Listed Products: Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Canadian Standards Association (CSA), and Electrical Testing Laboratories (ETL). Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority, to undergo a special inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

- D. Symbols: Except as otherwise indicated, refer to the symbol's legend on the Drawings for definitions of symbols used on the Drawings to show electrical work.
- E. Coordination Meetings: The Contractor shall include as Work of this section of the specifications the requirement for the following coordination meetings to be held at the project site. The primary function of the meetings shall be to ensure compliance with the requirements of the construction documents and facilitate timely performance of the contract. The Contractor shall have in attendance at each meeting a representative of the Division 16 subcontractor who is responsible for the execution of the Work of this contract. The preliminary schedule and agenda for each of the meetings shall be as described below. The specific dates for each of the meetings shall be scheduled by the Contractor and approved by the Construction Manager. The Construction Manager shall be provided with two (2) weeks minimum advanced written notice of proposed scheduled meeting dates.

1.07 PROJECT/SITE CONDITIONS

- A. Environmental Conditions: The following environmental conditions are typical for the project site. All electrical equipment and materials shall be sized and de-rated for the specified conditions:
1. Elevation: 5,500 feet above mean sea level
 2. Outdoor Temperature:
 - a. Winter: -10 to 40 °F
 - b. Summer: 40 to 105 °F
- B. Area Classifications: For the purpose of delineating the basic electrical construction materials and installation requirements for this project, areas of the project have been classified on the Drawings as defined below. Electrical work within these areas shall conform to the requirements described below as well as the referenced code requirements.
1. Dry Non-Process Areas (NEMA 1): Areas requiring general purpose, NEMA 1, construction are indoor areas typically environmentally controlled non-process areas such as electrical rooms.
 2. Wet Process Area (NEMA 4X): Areas requiring corrosion resistant, NEMA 4X, construction are all wet process areas and below grade vaults. Wet process areas typically contain damp conditions, wastewater, chemicals, or sludge pumping or piping systems and are subject to spills and washdown. Wet process areas shall also include those areas containing chemicals.
- C. Construction Materials: Construction materials required for each area classification are listed in Table 26 05 00-A appended to the end of this specification section. Refer to the individual specification section for each component for material composition and installation practices.

- D. Seismic: Electrical equipment and supports shall be braced in accordance with the Uniform Building Code for Seismic Zone 1.

1.08 HANDLING AND STORAGE

- A. Delivery: Deliver electrical materials and equipment properly packaged. Utilize factory fabricated containers or wrappings for materials and equipment which protect materials and equipment from damage. Inspect materials and equipment to ensure that no damage has occurred during shipment.
- B. Storage: Store electrical materials and equipment indoors in original packaging in areas specifically designated for equipment storage. Protect equipment and materials from construction traffic and debris.
- C. Handling: Handle electrical materials and equipment carefully to prevent physical damage to materials and equipment. Remove packaging, including the opening of crates and containers, avoiding the use of excessive hammering, and jarring which could damage the materials and equipment contained therein. Do not install damaged materials or equipment; remove from site and replace damaged materials and equipment with new.

PART 2 PRODUCTS

2.01 EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be new and free from defects. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

2.02 ELECTRICAL EQUIPMENT IDENTIFICATION

- A. General: Nameplates shall be made from laminated phenolic plastic. The nominal size of the nameplates shall be 3/4-inch-high by 2 inches long. Nameplates shall have white backgrounds with 3/16-inch black letters. Nameplate engraving shall minimally identify the equipment or equipment served by the labeled device and shall be in complete English terminology as indicated on the Drawings. Nameplates shall be attached with epoxy-based adhesive.
- B. Legends: Descriptions given on the one-line diagrams; panel schedules shall be used as the basis for nameplate engraving. In addition to the English description, each nameplate shall also indicate the equipment or device tag number. Additional engraving legend requirements shall be as defined below. If abbreviations are required because of space limitations, abbreviations shall be submitted to the Engineer for approval.
- C. Equipment: Nameplates shall be provided for the following equipment. Additional engraving requirements shall be as indicated in parenthesis for each equipment type.
 - 1. Panelboards, electrical cabinets, and enclosures
 - 2. Electrical switchgear and switchboards
 - 3. Control panels
 - 4. Control stations (indicating equipment controlled)
 - 5. Power transfer equipment
 - 6. Transformers (indicating power source and equipment served)

7. Disconnect, transfer, and bypass switches (indicating power source and equipment controlled)
8. Local motor starters (indicating power source and equipment controlled)

2.03 CUTTING AND PATCHING

- A. Comply with the requirements of the General Conditions for the cutting and patching of other work to accommodate the installation of electrical work. Except as individually authorized by the Construction Manager, cutting, and patching of electrical work to accommodate the installation of other work is not permitted.

2.04 EXCAVATING FOR ELECTRICAL WORK

- A. General: The work of this article is defined to include whatever excavating and backfilling is necessary to install the electrical work. Coordinate the work with other excavating and backfilling in the same area, including dewatering, flood protection provisions, and other temporary facilities. Coordinate the work with other work in the same area, including other underground services (existing and new), landscape development, paving, and floor slabs on grade. Coordinate with weather conditions and provide temporary facilities needed for protection and proper performance of excavating and backfilling.
 1. General Standards: Except as otherwise indicated, comply with the applicable provisions of General Conditions for electrical work excavating and backfilling. Refer instances of uncertain applicability to the Construction Manager for resolution before proceeding.
 2. Replacement of Other Work: Where it is necessary to remove and replace landscape work, pavement, flooring, and similar exposed finish work, engage the original installer to install the replacement work; except where work existed prior to the work of this Contract, engage only experienced and expert firms and tradespersons to replace the work.

2.05 CONCRETE FOR ELECTRICAL WORK

- A. General: The work of this article is defined to include whatever concrete work is necessary or shown specifically to install the electrical work; but excluding equipment base grouting (see applicable Division 26 sections). Coordinate the work with other work, particularly other concrete work, and accessories.
 1. General Standards: Refer to Structural specifications for all concrete standards.

2.06 HOUSEKEEPING

- A. General: Electrical equipment shall be protected from dust, water, and damage during the construction period. Electrical equipment including motor control centers, motor controllers, panelboards, switchgear, and buses shall be wiped free of dust and dirt on the outside and kept dry.
- B. Upon completion of the work, remove all litter, waste material, unused materials, and Contractor's tools and equipment from the job site.
- C. Remove all construction debris, packing materials, shipping labels, etc., from the interior and exterior of the equipment. Thoroughly clean and remove construction markings from interior surfaces.
- D. Clean exterior surfaces of equipment of all construction debris and markings and leave the equipment in an unblemished condition.

- E. Clean all equipment filters in accordance with the manufacturer's instructions.
- F. Touch-up scratched or marred surfaces to match original finish.

2.07 TESTING

- A. The tests specified in Section 26 08 00 of these specifications shall be performed prior to energizing the electrical circuits.

2.08 CLOSEOUT

- A. General: Refer to the General Conditions sections for general closeout requirements.
- B. Lubrication: Clean and lubricate operational equipment.
- C. Training: Instruct Owner's personnel thoroughly in the operation, sequencing, maintenance, and safety/emergency provisions of the electrical systems.

2.09 MAINTENANCE MATERIALS

- A. Extra stock of spare parts, materials, replacement units, accessories, adjustment devices, and similar items as designated, for the Owner's initial use in maintaining the electrical equipment and systems in continued operation. Maintenance materials shall be furnished where specified in each equipment specification.

2.10 RECORD DOCUMENTS

- A. Record documents refer to those documents maintained and annotated by the Contractor during construction, and include record drawings in accordance with General Conditions sections, and the following additional schedules, lists, and drawings:
 - 1. Interconnection Diagrams (26 05 00, Part 1).
 - 2. Original Submittal Drawings (26 05 00, Part 1).

PART 3 EXECUTION

3.01 INSPECTION

- A. Examine areas and conditions under which equipment is to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the Installer.

3.02 GENERAL

- A. Coordinate equipment installation work with electrical raceway and wire/cable work, as necessary for proper interface.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standard 486A. Use properly scaled torque indicating hand tool.

- C. Cables larger than No. 6 AWG which hang from their vertical connections shall be supported from the structure within 2 feet of the connection.

3.03 INSTALLATION OF FREESTANDING EQUIPMENT

- A. Install equipment at the locations indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. The floor or slab upon which the freestanding equipment is installed shall be smooth and level (within 1/8 inch per three feet in any direction). Mount the equipment in accordance with manufacturer's instructions.

3.04 INSTALLATION OF WALL-MOUNTED EQUIPMENT

- A. Install equipment at the locations indicated, complying with manufacturer's written instructions, applicable requirements of NEC and NECA standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- B. Equipment mounting height shall be 72 inches above finished floor to top of equipment enclosure.
- C. Equipment enclosure shall be mounted on u-channel supports anchored to associated wall.
- D. Conduits shall be terminated on the sides and bottom of enclosures. Conduits shall not be installed in the top of the enclosure without approval of the Construction Manager.

3.05 GROUNDING

- A. Provide equipment grounding connections to equipment as indicated. Tighten connections to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

3.06 FIELD QUALITY CONTROL

- A. Field inspection and testing of equipment shall be completed prior to energizing the equipment.
- B. Prior to energization of electrical circuitry, check all accessible connections to manufacturer's tightening torque specifications.

3.07 ADJUSTING AND CLEANING

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.

3.08 RUBBER MATS

- A. A three-foot-wide rubber mat shall be furnished and installed on the floor and in front of each piece of electrical equipment located indoors. The mat shall be long enough to cover the full length of each enclosure. The mat shall be 1/4 inch thick with beveled edges, canvas back, solid type with corrugations running the entire length of the mat. The mat shall be guaranteed extra quality, free from cracks, blow holes or other defects detrimental to their mechanical or electrical strength. The mat shall meet OSHA requirements and the requirements of ANSI/ASTM D 178 J6-7 for Type 2, Class 2 insulating matting.

TABLE 26 05 00-A

Component	Area Classification			
	Dry Non Process Area (NEMA 1)	Wet Process Area (NEMA 4X)	Outdoors (NEMA 4X)	Chemical Areas (NEMA 4X)
Rigid Conduit (exposed)	GRS	PGRS	GRS	PVC Schedule 80
Rigid Conduit (concealed) ⁴	GRS	GRS	GRS	PVC Schedule 40
Flexible Conduit ⁵	FMC	LFMC	LFMC	LFMC
Support Systems	Galvanized Steel	Stainless Steel	Stainless Steel	Stainless Steel/PVC
Fastening Hardware and Hanger Rods ^{2,3}	Cadmium Plated Steel	Stainless Steel	Stainless Steel	Stainless Steel
Control Stations & Enclosures ^{2,3}	Steel	Stainless Steel	Stainless Steel	Fiberglass/PVC
Receptacles ²	General	WP, GFCI	WP, GFCI	WP, GFCI, NM
Switches ²	General	WP	WP	WP, NM

Table A Notes:

1. Enclosures, device boxes, control stations, and raceway systems shall be mounted with 1/4-inch (minimum) air space between the electrical system and supporting structure.
2. Conduit terminations to control stations, enclosures, and device boxes in NEMA 4X, 7, and 12 areas shall be made through gasketed threaded hubs. Chemical Areas shall use Plastic Non-Metallic enclosures.
3. Control station and enclosure NEMA sealing ratings shall meet or exceed the rating designated by the area classification.
4. Conduit encased in concrete duct bank, direct buried, or beneath slab on grade shall be rigid nonmetallic conduit, raceway type PVC8. Conduit concealed in concrete walls shall be raceway type GRS.
5. Flexible conduit shall be utilized for final connections to equipment.
6. Install per the NEC.

Legend:

GRS – Galvanized Steel Conduit
PGRS – PVC Coated Galvanized Steel Conduit
FMC – Flexible Metallic Conduit
LFMC – Liquid tight Flexible Metallic Conduit
PVC8 – Schedule 80 PVC
WP – Weatherproof
GFCI – Ground Fault Circuit Interrupter
NM – Non-Metallic

Refer to 26 05 33.23 for additional requirements and details on conduit types and requirements.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, all low voltage wire and cable indicated on the Drawings and as specified herein and/or required for proper operation. The work of connecting cables to equipment and devices shall be considered a part of this Section. All appurtenances required for the installation of cable and wire systems shall be furnished and installed by the Contractor.
- B. The scope of this Section does not include internal wiring factory installed by electrical equipment manufacturers.
 - 1. Reference Section 26 05 00, Common Work Results for Electrical; Section 26 05 33.23, Low-Voltage Electrical Power Conductors and Cables.

1.02 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the General Conditions, the Contractor shall obtain from the wire and cable manufacturer and submit the following:
 - 1. Shop Drawings
 - 2. Reports of Field Tests
 - 3. Wiring Identification Methods
- B. Each submittal shall be identified by the applicable specification section.

1.03 SHOP DRAWINGS

- A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.
- B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.
- C. Shop drawings shall include but not be limited to:
 - 1. Product data sheets.
 - 2. Cable pulling calculations (if required).
 - 3. Wiring identification methods and materials.
 - 4. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor and Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with

the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.04 IDENTIFICATION

- A. Each cable shall be identified as specified in Part 3, Execution, of this Specification.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years. Wire and cable shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and indicated on the Drawings. Only one (1) manufacturer for each wire and cable type shall be permitted.
- B. The wire and cable manufacturer shall be ISO 9000 registered.

2.02 POWER WIRE AND CABLE

- A. Power cable and wire installed underground, in wet process areas, or between the output terminals of a VFD and the respective motor shall consist of stranded copper conductor with insulation type XHHW/XHHW-2, rated 90°C and 600V.
- B. Power cable and wire for all other loads shall consist of stranded, copper conductor with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations.
- C. Conductors shall be stranded copper per ASTM-B8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum size wire shall be No. 12 AWG.
- D. Multi-conductor power cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.
- E. Power wire and cable shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, or equal.

2.03 CONTROL CABLE

- A. Control cable and wire installed underground or in wet process areas shall consist of stranded copper conductor with insulation type XHHW/XHHW-2, rated 90°C and 600V.
- B. Control cable for all other locations shall consist of stranded, copper conductor with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations, and 600V.
- C. Conductors shall be stranded copper per ASTM B-8 and B-3, and Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be No. 14 AWG.

- D. Multi-conductor control cable assemblies shall be UL 1277 Listed, provided with a bonding conductor, and furnished with an overall PVC jacket.
- E. Control cable shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, or equal.

2.04 LIGHTING AND RECEPTACLE WIRE

- A. The lighting and receptacle branch circuit wire shall consist of solid, copper conductors with insulation type THHN, 90°C for dry locations and THWN, 75°C for wet locations.
- B. Conductors shall be solid copper per ASTM- B-3. Minimum size wire shall be No. 12 AWG.
- C. Lighting and receptacle wire shall be as manufactured by the Okonite Company, the Southwire Company, General Cable, or equal.

2.05 INSTRUMENTATION CABLE

- A. The instrumentation cable for analog signals shall be single, shielded, twisted pairs or triads with 600-volt insulation and shall have a 75°C (minimum) insulation rating.
- B. Conductors shall be tin, or alloy coated (if available), soft, annealed copper, stranded per ASTM-B8, Class B stranding unless otherwise specified. Minimum size wire shall be No. 16 AWG.
- C. The instrumentation cable shall be Okoseal-N Type P-OS for single pair or triad applications and Okoseal-N Type SP-OS for multiple pair or triad applications as manufactured by the Okonite Company, Belden equivalent, Southwire Company equivalent, or equal.

2.06 CONDUCTOR IDENTIFICATION

- A. Conductors shall be identified using a color coding method. Color coding for individual power, control, lighting, and receptacle conductors shall be as follows:
 - 1. 480/277V AC Power
 - a. Phase A BROWN
 - b. Phase B ORANGE
 - c. Phase C YELLOW
 - d. Neutral - GREY
 - 2. 120/208V or 120/240V AC Power
 - a. Phase A BLACK
 - b. Phase B RED
 - c. Phase C BLUE
 - d. Neutral WHITE
 - 3. DC Power
 - a. Positive Lead RED
 - b. Negative Lead BLACK
 - 4. DC Control

- a. All wiring - BLUE
- 5. 120VAC Control
 - a. 120 VAC control wire shall be RED except for a wire entering a motor control center compartment or control panel which is an interlock. This interlock conductor shall be color coded YELLOW.
- 6. 24VAC Control
 - a. All wiring - ORANGE
- 7. Equipment Grounding Conductor
 - a. All wiring - GREEN
- B. Individual conductors No. 2 AWG and smaller shall have factory color coded insulation. It is acceptable for individual conductors larger than No.2 AWG to be provided with factory color coded insulation as well, but it is not required. Individual conductors larger than No.2 AWG that are not provided with factory color coded insulation shall be identified by the use of colored tape in accordance with the requirements listed in Part 3 herein. Insulation colors and tape colors shall be in accordance with the color-coding requirements listed above.
- C. Conductors that are a part of multi-conductor control cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor within the cable assembly shall also be identified with a heat shrink tag with color coded background in accordance with the requirements listed in Part 3 herein. Background color shall be in accordance with the color-coding requirements listed above.
- D. Conductors that are a part of multi-conductor power cable assemblies shall have black insulation. The conductor number shall be printed on each conductor's insulation in accordance with ICEA S-58-679, Method 4. Each conductor No.2 AWG and smaller within the cable assembly shall also be identified with a heat shrink tag with color coded background. Each conductor larger than No.2 AWG within the cable assembly shall also be identified by the use of colored tape. Heat shrink tags and colored tape shall be in accordance with the requirements listed in Part 3 herein. Tape color and heat shrink tag background color shall be in accordance with the color-coding requirements listed above.

2.07 CABLE PULLING LUBRICANTS

- A. Cable pulling lubricants shall be non-hardening type and approved for use on the type of cable installed. Lubricant shall be Yellow #77 Plus by Ideal, Cable Gel by Greenlee, Poly-Gel by Gardner Bender, or equal.

PART 3 EXECUTION

3.01 POWER, CONTROL, AND LIGHTING/RECEPTACLE WIRE AND CABLE INSTALLATION

- A. The wire and cable shall be installed as specified herein and indicated on the Drawings.
- B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.

- C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide-inhibiting joint compound recommended for "copper-to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or equal.
- D. Splices shall not be allowed in the underground manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing. Splicing materials shall be barrel type butt splice connectors and heat shrink tubing as manufactured by 3M, Ideal, or equal. No splicing of instrumentation cable is allowed. The use of screw-on wire connectors (wire nuts) shall only be permitted for lighting and receptacle circuits.
- E. Wire and Cable Sizes
1. The sizes of wire and cable shall be as indicated on the Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be increased so that the voltage drop measured from source to load does not exceed 2-1/2%.
- F. Additional Conductor Identification
1. In addition to the color coding identification requirements specified in Part 2 herein, individual conductors shall be provided with heat shrinkable identification tags. Identification tags for individual conductors shall have a white background where the conductor insulation is colored. Identification tags for individual conductors shall have a colored background where the conductor insulation is black. Background color shall match that of the taping provided on the individual black conductors.
 2. Multi-conductor cables shall be provided with heat shrinkable identification tags in accordance with Part 2 herein.
 3. All wiring shall be identified at each point of termination. This includes but is not limited to identification at the source, load, and in any intermediate junction boxes where a termination is made. The Contractor shall meet with the Owner and Engineer to come to an agreement regarding a wire identification system prior to installation of any wiring. Wire numbers shall not be duplicated.
 4. Wire identification shall be by means of a heat shrinkable sleeve with appropriately colored background and black text. Wire sizes #14 AWG through #10 AWG shall have a minimum text size of 7 points. Wire sizes #8 AWG and larger shall have a minimum text size of 10 points. Sleeves shall be of appropriate length to fit the required text. The use of handwritten text for wire identification shall not be permitted.
 5. Sleeves shall be suitable for the size of wire on which they are installed. Sleeves shall not be heat-shrunk onto control cables. Tags shall remain loose on cable to promote easier identification. For all other applications, sleeves shall be tightly affixed to the wire and shall not move. Sleeves shall be heat shrunk onto wiring with a heat gun approved for the application. Sleeves shall not be heated by any means which employs the use of an open flame. The Contractor shall take special care to ensure that the wiring insulation is not damaged during the heating process.
 6. Sleeves shall be installed prior to the completion of the wiring terminations and shall be oriented so that they can be easily read.
 7. Sleeves shall be polyolefin as manufactured by Brady, Seton, Panduit, or equal.
 8. Wire identification in manholes, handholes, pull boxes, and other accessible components in the raceway system where the wiring is continuous (no terminations are made) shall be accomplished by means of a tag installed around the bundled group of individual conductors or around the outer conductor jacket of a multi-conductor cable. Identification

shall utilize a FROM-TO system. Each group of conductors shall consist of all of the individual conductors in a single conduit or duct. The tag shall have text that identifies the bundle in accordance with the 'FROM' and 'TO' column for that particular conduit number in the conduit and wire schedule. Minimum text size shall be 10 point. The tag shall be affixed to the wire bundle by the use of nylon wire ties, and shall be made of polyethylene as manufactured by Brady, Seton, Panduit, or equal.

9. Where colored tape is used to identify cables, it shall be wrapped around the cable with a 25% overlap and shall cover at least 2 inches of the cable.

G. Wiring Supplies

1. Only electrical wiring supplies manufactured under high standards of production and meeting the approval of the Engineer shall be used.
2. Rubber insulating tape shall be in accordance with ASTM Des. D119. Friction tape shall be in accordance with ASTM Des. D69.

H. Training of Cable

1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes and handholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each handhole, manhole, and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. The training shall be done in such a manner as to minimize chaffing.
2. Instrumentation cable shall be racked separate from other AC and DC wiring to maintain the required separation as follows:
 - a. 8 inches for 480/277VAC wiring
 - b. 12 inches for 208/120VAC wiring
 - c. 6 inches for 24VDC wiring

I. Conductor Terminations

1. Where wires are terminated at equipment which requires lugs, connections shall be made by solderless mechanical lug, crimp type ferrule, or irreversible compression type lugs. Reference individual equipment specification sections as applicable for additional termination requirements.
2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make terminations impractical due to the size of the field wiring, the Contractor shall terminate field wiring in an adjacent junction per the requirements of Section 16130, Boxes, complete with terminal strips. Contractor shall install the smaller wiring from the device to the junction box in a conduit, using the terminal strip as the means for joining the two different wire sizes. Splicing of wires in lieu of using terminal strips is not acceptable.
3. All spare conductors shall be terminated on terminal blocks mounted within equipment or junction boxes. Unless otherwise noted, coiling up of spare conductors within enclosure is not acceptable.

J. Pulling Temperature

1. Cable shall not be flexed or pulled when the temperature of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature of 40°F or less within a three (3) day period prior to pulling, the cable reels shall be stored three (3) days prior to pulling in a protected storage area with an ambient temperature of 55°F or more. Cable pulling shall be completed during the work day for which the cable is removed from the protected storage. Any remaining cable reels shall be returned to storage at the completion of the workday.

3.02 INSTRUMENTATION CABLE INSTALLATION

- A. The Contractor shall install all cable or conductors used for instrumentation wiring (4-20 mA DC, etc.) in conduit as specified in Section 260533.23 – Surface Raceways for Electrical Systems. Only instrumentation cable as specified herein shall exclusively occupy these conduits. No other wiring for AC or discrete DC circuits shall be installed in these conduits.
- B. All shielding shall be continuous and shall be grounded at one point only.
- C. Where instrumentation cables are installed in panels, manholes, handholes, and other locations, the Contractor shall arrange wiring to provide maximum clearance between these cables and other conductors. Instrumentation cables shall not be installed in same bundle with conductors of other circuits.
- D. Special instrument cable shall be as specified or recommended by the manufacturer of the equipment or instruments requiring such wiring. Installation, storage, and terminations shall be per manufacturer's recommendations.

3.03 TESTING

- A. All testing shall be performed in accordance with the requirements of the General Conditions. The following tests are required:
 1. Shop Test
 - a. Cable and wiring shall be tested in accordance with the applicable ICEA Standards. Wire and cable shall be physically and electrically tested in accordance with the manufacturer's standards.
 2. Field Tests
 - a. After installation, all wires and cables shall be tested for continuity. Testing for continuity shall be "test light" or "buzzer" style.
 - b. After installation, some wires and cables shall be tested for insulation levels. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:
 - 1) For #8 AWG and larger 600V power and control cable, apply 1,000 VDC from a Megaohmmeter for one (1) minute for all 600V wires and cables installed in lighting, control, power, indication, alarm, and motor feeder circuits. Resistance shall be no less than 100 Megaohms. Insulation testing is not required for power and control cables smaller than #8 AWG.

- 2) 600V instrumentation signal cable shall be tested from conductor to conductor, conductor to shield, and conductor to ground using a Simpson No. 260 volt-ohmmeter or approved equal. The resistance value shall be 200 Megaohms or greater.
- B. Wires and cables shall be tested before being connected to motors, devices or terminal blocks.
 - C. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace the cable as directed by the Engineer, without additional cost to the Owner.
 - D. All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment. Test reports shall be submitted to the Engineer.

(EXHIBIT A)
TEST DATA - MEGOHMS
TEST NO. ____

Part Tested: Test Made: _____
Hours/Days: _____
After Shutdown: _____

Grounding Time: _____ Dry Bulb Temperature: _____
Wet Bulb Temperature: _____

Test Voltage: _____	Equipment Temperature: _____ How Obtained: _____ Relative Humidity: _____ Absolute Humidity: _____ Dew Point: _____
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Megohmmeter: Serial Number: _____ Range: _____
Voltage: _____ Calibration Date _____

Test Connections	To Line	To Line	To Line	Test Connections	To Line	To Line	To Line
	To Earth	To Earth	To Earth		To Earth	To Earth	To Earth
	To Ground	To Ground	To Ground		To Ground	To Ground	To Ground
<input type="checkbox"/> Minute				5 Minutes			
<input type="checkbox"/> Minute				6 Minutes			
3/4 Minute				7 Minutes			
1 Minute				8 Minutes			
2 Minutes				9 Minutes			
3 Minutes				10 Minutes			
4 Minutes				10/1 Minutes			
				Ratio			

Remarks:

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered a minimum requirement for compliance with this Specification.
- B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100-92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.
- C. In addition to the NEC requirements, building structural steel columns and metallic chemical and process storage tank shall be permanently and effectively grounded.

1.02 RELATED SECTIONS

- A. General Conditions – Coordination and Meetings
- B. General Conditions – Submittals
- C. Section 26 05 00 – Common Work Results for Electrical
- D. Section 26 05 33.23 – Surface Raceways for Electrical Systems

1.03 REFERENCES

- A. UL 467 – Grounding and Bonding
- B. IEEE81 – Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System

1.04 ACTION SUBMITTALS

- A. Submittals shall be in accordance with the General Conditions and as specified herein.
- B. Shop Drawings - Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents
 - 1. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.
 - 2. Shop drawings shall include but not be limited to:
 - a. Product data sheets.
 - b. Drawings and written description of how the Contractor intends to furnish and install the grounding system.

- c. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

C. Results of certified field tests.

D. Manufacturer's Certification - Certify that products meet or exceed specified requirements.

E. Identified by applicable specification section.

1.05 INFORMATION SUBMITTALS

A. Submittals shall be in accordance with the General Conditions, and as specified herein.

B. Prior to start-up, submit manufacturer's operation and maintenance manuals and recommended spare parts list, including but not limited to:

1. Manufacturer's equipment warranty.
2. Copies of Submittals
3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety
4. Contact information for local representative and supplier.

1.06 HANDLING AND STORAGE

A. Equipment shall be carefully transported, stored, handled, and set in place in a manner that will prevent damage, misalignment, and distortion to the components.

B. Follow manufacturer's recommendations regarding handling and storage at all times prior to installation of the equipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 GROUND RODS AND GRID

- A. Ground rods shall be rolled to a commercially round shape from a welded copper clad steel manufactured by the molten welding process or by the electro formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 pounds per square inch (psi) and an elastic limit of 49,000 psi. The rods shall be not less than 3/4 inch in diameter by 10 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.010 inch at any point on the rod. Ground rods shall be UL 467 listed. The ground rods shall be manufactured by Erico Products, Blackburn, or equal.
- B. Except where specifically indicated otherwise, all exposed non-current carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.
- C. The ground connection shall be made at the main service equipment and shall be extended to the ground grid surrounding the structure. The ground grid shall also be connected to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a suitable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection.
- D. Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.03 FITTINGS

- A. Grounding connections to equipment shall be bolted. Cable end connections shall be made by hydraulic irreversible crimp or exothermically welded. Split bolt type connectors are not acceptable. Fittings shall be UL 467 listed.

2.04 EQUIPMENT GROUNDING CONDUCTORS

- A. An insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Insulation shall be of the same type as the underground conductors in the raceway and shall be green in color. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.

2.05 EQUIPMENT GROUNDS

- A. Equipment grounds shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.06 EXOTHERMIC WELDS

- A. All exothermic welding shall be completed per welding kit manufacturer's instructions. Exothermic welds shall be CadWeld by Erico or ThermoWeld.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Metal surfaces where grounding connections are to be made shall be clean, free of paint, and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.
- B. Ground Grid
1. A main ground grid shall be provided for each structure and interconnecting structure grids consisting of driven ground rods as shown on the Drawings. The ground rods shall be interconnected by the use of copper cable exothermically welded or hydraulic irreversible crimp to the rods. The grounding cables shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtailes" shall be connected to the ground grid and shall enter the buildings and structure from the outside and shall be connected to steel structures, and equipment as described in this Section and as required to provide a complete grounding system. The copper pigtailes shall be exothermically welded or hydraulic irreversible crimp to the ground grid and connected to building reinforcement steel by hydraulic irreversible crimp.
 2. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.
 3. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in metal raceway. The raceway shall be bonded to the grounding system.
 4. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.
 5. Buried exothermic welds and ground ring shall not be backfilled until inspected by Engineer.
 6. All hydraulic irreversible crimp connections shall be made using a manufacturer approved tool.
- C. Raceways
1. Conduit which enters equipment such as switchgear, motor control centers, transformers, panelboards, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus or ground lug, where provided, and as otherwise required by the NEC.

3.02 TESTING & STARTUP

- A. All tests shall be performed in accordance with the requirements of the General Conditions. The following tests are required:
1. Witnessed Shop Tests
 - a. None required.
 2. Field Tests

- a. Field testing shall be done in accordance with the requirements specified in the General Conditions and NETA Acceptance Testing Specifications, latest edition.
- b. Fall of potential tests shall be performed on the ground grid per IEEE81 recommendations by a third party, independent testing firm. A fall of potential plot shall be submitted at the conclusion of testing for Engineer review. Documentation indicating the location of the rod and grounding system as well as the resistance and soil conditions at the time the measurements were made shall be submitted. Testing shall show that the ground grid has 5 ohms resistance or less. Due to soil conditions and/or unforeseen field conditions, ground resistances greater than 5 ohms may be acceptable if specifically approved in writing by the Engineer. Ground resistance measurements shall be made in normally dry weather not less than 48 hours after rainfall and with the ground grid under test isolated from other grounds.
- c. Continuity tests for the grounding electrode conductor shall also be performed. Test will be accepted when a resistance of less than 1 ohm is shown for this conductor.

END OF SECTION

SECTION 26 05 33.16

BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The scope of work under this Section includes furnishing and installing all pull boxes, junction boxes, and outlet boxes.
- B. Requirements for other boxes and enclosures are not included in this Section. Reference each specific Division 26 equipment Section for requirements related to that equipment's respective enclosure.

1.02 RELATED SECTIONS

- A. General Conditions – Coordination and Meetings
- B. General Conditions – Submittals
- C. Section 26 05 00 – Common Work Results for Electrical
- D. Section 26 05 33.23 – Surface Raceways for Electrical Systems

1.03 REFERENCES

- A. UL 514A – Metallic Outlet Boxes
- B. UL 514C – Standard for Non-metallic Outlet Boxes, Flush Device Boxes, and Covers
- C. UL 50 – Enclosures for Electrical Equipment, Non-environment Considerations
- D. UL 50E – Enclosures for Electrical Equipment, Environmental Considerations
- E. UL 1203 – Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations
- F. NEMA 250 – Enclosures for Electrical Equipment

1.04 ACTION SUBMITTALS

- A. Submittals shall be in accordance with the General Conditions and as specified herein.
- B. Product Datasheets
- C. Layout Drawings for all boxes larger than standard receptacle boxes.
- D. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the CONTRACTOR AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be

for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

- A. Submittals shall be in accordance with the General Conditions and as specified herein.
- B. Prior to start-up, submit manufacturer's operation and maintenance manuals and recommended spare parts list, including but not limited to:
 - 1. Manufacturer's equipment warranty.
 - 2. Copies of Submittals
 - 3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety
 - 4. Contact information for local representative and supplier.

1.06 HANDLING AND STORAGE

- A. Follow manufacturer's recommendations regarding handling and storage at all times prior to placing the devices in service.

PART 2 PRODUCTS

2.01 PULL AND JUNCTION BOXES

- A. General
 - 1. All pull and junction boxes shall be UL listed and labeled.
 - 2. Pull and junction boxes shall not be provided with eccentric or concentric knockouts.
 - 3. Pull and junction boxes mounted embedded in concrete shall be UL listed for embedment.
 - 4. Where metallic boxes are used, they shall be of all welded construction. Tack welded boxes are not acceptable.
- B. Pull Boxes
 - 1. All pull boxes shall be provided with a matching gasketed cover. For covers with dimensions of 24 inches by 24 inches or less, the cover shall be held in place by machine screws. Other screw types are not acceptable. For covers with dimensions greater than 24 inches by 24 inches, the cover shall be hinged and held in place by screw-operated clamp mechanisms. Hinge pins shall be removable. Clamp mechanism material of construction shall match that of the associated box.
 - 2. Pull boxes shall not have any wire terminations inside, other than those for grounding/bonding. A ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the pull box (minimum of two) shall be provided as spare terminations. Boxes requiring any other wire terminations shall be furnished and installed in accordance with the requirements for junction boxes herein.

3. Pull boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC
4. Barriers shall be provided in pull boxes to isolate conductors of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:
 - a. Power wiring
 - b. AC Control wiring
 - c. DC Control wiring
 - d. Instrumentation wiring

C. Junction Boxes

1. Junction boxes used for lighting and receptacle circuits only shall be provided with a matching gasketed cover held in place by machine screws. Other screw types are not acceptable.
2. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with a hinged, gasketed cover. Hinge pins shall be removable. Cover shall be held in place by screw-operated clamp mechanisms. Clamp mechanism material of construction shall match that of the associated box.
3. Barriers shall be provided in junction boxes to isolate conductors and terminal blocks of different voltages, types, and functions. Barrier material of construction shall match that of the box. Isolation shall be provided between the following groups:
 - a. Power wiring
 - b. AC control wiring
 - c. DC control wiring
 - d. Instrumentation wiring
4. Junction boxes used for lighting and receptacle circuits only shall be allowed to have screw-on (wire nut) type connectors for wire terminations/junctions.
5. Junction boxes for all uses other than lighting and receptacle circuits shall be provided with terminal strips, consisting of the necessary number of screw type terminals. Current carrying parts of the terminal blocks shall be of ample capacity to carry the full load current of the circuits connected, with a 10A minimum capacity. Terminal strips shall be rated for the voltage of the circuits connected. A separate ground bar shall be provided with the necessary number of screw type terminals. Twenty (20) percent of the total amount of terminals otherwise required for the junction box (minimum of two) shall be provided as spare terminations. When barriers are provided within the box, separate terminal strips shall be provided in each barrier area. Terminals shall be lettered and/or numbered to conform to the wiring labeling scheme in place on the project.
6. Junction boxes shall be 6 inches wide by 6 inches tall by 4 inches deep, minimum. For applications requiring larger boxes, the box shall be sized in accordance with the fill requirements and dimensional requirements of the NEC. Terminal blocks (including spare terminals) shall be considered when sizing the junction box.

D. Enclosure Types and Materials

1. In non-hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Wet Process Area	NEMA 4X, Type 316 Stainless Steel
Indoor Dry Process Area	NEMA 12, Painted Steel
Indoor Dry Non-process Area	NEMA 12, Painted Steel
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, Fiberglass or PVC
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Type 316 Stainless Steel
All Outdoor Areas	NEMA 3R, Gasketed, Painted Steel

2. In hazardous locations, pull and junction boxes shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	ENCLOSURE TYPE AND MATERIAL
Class 1, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D	NEMA 4X, Type 316 Stainless Steel
Class 2, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class 2, Division 2, Group F	NEMA 4X, Type 316 Stainless Steel

3. Non-metallic enclosures, NEMA 7 enclosures, and NEMA 9 enclosures shall be provided with threaded integral conduit hubs.

2.02 OUTLET BOXES

A. General

1. Outlet boxes shall be provided with a trim appropriate for the wiring device installed inside. Reference Section 262726, Wiring Devices, for outlet box trim requirements. An appropriate outlet box trim is required to achieve the NEMA rating of the outlet boxes as specified herein.

B. Surface Mount Outlet Boxes

1. Outlet boxes shall be the deep type, no less than 2.5 inches deep.
2. Outlet boxes shall be provided in single or multi-gang configuration as required, sized in accordance with the requirements of the NEC.
3. In non-hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Wet Process Area	NEMA 4X, Cast Aluminum
Indoor Dry Process Area	NEMA 1, Cast Iron
Indoor Dry Non-process Area	NEMA 1, Cast Iron

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Type 1 Chemical Storage/Transfer Area	NEMA 4X, PVC
Indoor Type 2 Chemical Storage/Transfer Area	NEMA 4X, Cast Aluminum
All Outdoor Areas	NEMA 4X, Cast Aluminum

4. In hazardous locations, outlet boxes shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	ENCLOSURE TYPE AND MATERIAL
Class 1, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class 1, Division 2, Group D	NEMA 4X, Cast Aluminum
Class 2, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class 2, Division 2, Group F	NEMA 4X, Cast Aluminum

5. Outlet boxes shall be provided with integral threaded conduit hubs mounted external to the box. Boxes with threaded conduit hubs mounted internal to the box or as a part of the box wall are not acceptable.

C. Flush Mount Outlet Boxes

- Outlet boxes shall be no less than 2-1/8 inches deep, and 4-11/16 inches square. Boxes shall be UL listed and labeled. Pre-punched single diameter conduit knockouts are acceptable; however, concentric, and eccentric knockouts are not acceptable.
- Outlet boxes mounted flush in CMU walls shall be made of galvanized, tack welded steel, and suitable for installation in masonry walls. Sectional type boxes are not acceptable for this application.
- Outlet boxes mounted flush in gypsum walls shall be made of galvanized pressed steel. Tack welded boxes are not acceptable for this application. Sectional type boxes are not acceptable for this application.
- Outlet boxes mounted cast into concrete shall be concrete tight and shall be made of galvanized steel or PVC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Pull and Junction Boxes

- Pull boxes and junction boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.
- Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.
- Box penetrations for conduits shall be made with a punch tool, and penetrations shall be of the size required for the conduit entry and/or hub. Oversized penetrations in boxes are not acceptable.

4. Watertight conduit hubs shall be provided for boxes where a NEMA 3R or NEMA 4X enclosure rating is specified. Reference Section 260533.23, Surface Raceways for Electrical Systems for conduit hub requirements.
5. Pull and junction boxes may be installed flush mounted in gypsum, concrete or CMU walls where appropriate provided that covers are easily removed or opened.
6. Pull and junction boxes shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

B. Outlet Boxes

1. Outlet boxes shall be solidly attached to structural members prior to installation of conduit and set true and plumb. Boxes shall not be supported by their associated conduits.
2. Wooden plugs are not permitted for securing boxes to concrete. Appropriately rated anchors specifically suited for use in concrete shall be used.
3. Flush mounted outlet boxes shall be arranged and located so that tile and grout lines fit closely around the boxes, and so placed that the cover or device plate shall fit flush to the finished wall surface.
4. Outlet boxes shall be flush mounted in finished areas and other areas where practical. Flush mounted outlet boxes shall not be installed in hazardous areas and type 1 or 2 chemical storage/transfer areas.
5. For the below-named items, mounting heights from finished floor, or finished grade to top is applicable, depending on the type of wiring device to be installed in the outlet box. Mounting heights for outlet boxes shall be as follows, unless otherwise specified herein, indicated on the Drawings, or required by the Americans with Disability Act (ADA):
 - a. Light switches and wall mounted occupancy sensors, 48 inches
 - b. Receptacles in indoor dry process/non-process areas, 16 inches
 - c. Receptacles in indoor wet process areas and all indoor chemical storage/transfer areas, 48 inches
 - d. Receptacles in outdoor locations, 24 inches
 - e. Ceiling mounted occupancy sensors, as indicated on the Drawings.
6. Outlet boxes shall be provided in the material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

END OF SECTION

SECTION 26 05 33.23

SURFACE RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. Under this Section, the Contractor shall furnish and install all conduits and conduit fittings to complete the installation of all electrically operated equipment as specified herein and as required.
- B. The Drawings indicate the general location of conduits both exposed and concealed; however, the Contractor shall install these conduits in such a manner to avoid all interferences.
- C. Reference Section 26 05 00 – Common Work Results for Electrical
- D. All Contractor personnel installing PVC coated rigid conduit shall be trained as specified herein.

1.02 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the General Conditions and Section 01 33 00, Submittals, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable Specification section.

1.03 SHOP DRAWINGS

- A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.
- B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.
- C. Shop drawings shall include but not be limited to:
 - 1. Product data sheets.
 - 2. Conduit identification methods and materials.
 - 3. Evidence of training (e.g., Certificates of Completion) for all Contractor personnel that will install PVC coated rigid conduit. Training shall be as specified herein.
 - 4. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable concerns. Material shall be fabricated, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as specified herein and shown on the Drawings.

2.02 CONDUITS

A. General

1. Unless specified otherwise herein, or indicated on the Drawings, all conduits shall be rigid, hot-dipped galvanized steel. Minimum size conduit shall be 3/4 inch unless otherwise indicated on the Standard Details. Unless specified otherwise herein or indicated on the Drawings, all encased conduits shall be PVC Schedule 40, minimum size 1 inch. The Contractor, at his option, for ease of installation to accommodate saddle size, may increase the size of encased conduits to 2-inch. However, no combining of circuits/conductors will be permitted in these larger conduits.
2. All components (fittings, couplers, connectors, etc.) of the conduit system shall be of the same or compatible material of construction. Coated conduit systems shall include factory coated fittings couplings, connectors, and other components compatible with and approved for coated conduit systems.
3. Reference the "Conduit Uses" portion of this specification for additional information regarding conduit.

B. Rigid Steel Conduit

1. Steel conduits shall be rigid type, heavy wall, hot-dipped galvanized inside and outside and as manufactured by Allied Tube and Conduit Corporation, Wheatland Tube Company, Jones & Laughlin Steel Company, or equal.
2. Each length of conduit shall be shipped with a coupling on one end and a color-coded thread protector at the other end.

C. Rigid Aluminum Conduit

1. Aluminum conduits shall be rigid type, heavy walled as manufactured by Allied Tube and Conduit Corporation, Wheatland Tube Company, Jones & Laughlin Steel Company, or approved equal.
2. Rigid aluminum conduit shall be manufactured of 6063 alloy in temper designation T1. Fittings shall be of the same alloy.
3. Rigid aluminum conduit shall be listed by Underwriters' Laboratories to U.L. Standard 6A shall be manufactured to ANSI Standard C80.5.
4. Each length of conduit shall be shipped with a coupling on one end and a color-coded thread protector at the other end.

D. Flexible Metal Conduit

1. Flexible metal conduit (FMC) shall be galvanized steel, single strip. FMC shall be UL listed. FMC shall be used to connect all indoor vibrating equipment, installed in dry locations, above reflected ceilings to lighting fixtures, and other applications as accepted

by the Engineer. FMC shall be Galflex Type RWS as manufactured by Southwire, Type BR as manufactured by Electri-Flex, or equal.

E. Liquid Tight Flexible Metal Conduit

1. Liquid tight flexible conduit (LFMC) shall be galvanized steel, single strip, with a copper strip interwoven and suitable as a grounding means. LFMC shall be UL listed. LFMC shall have an extruded moisture and oil-proof PVC jacket. LFMC shall be Titan Type UL as manufactured by Southwire, Liguatite Type "LA" as manufactured by Electri-Flex, Anaconda Type UA as manufactured by Anamet Electrical, Inc., or equal.
2. PVC coated or stainless-steel watertight connectors shall be used with liquid tight flexible metal conduit on both ends. LFMC shall be used to connect all vibrating equipment installed outdoors, in wet or damp areas, and other applications as directed by the Engineer.

F. Liquid Tight Flexible Non-Metallic Conduit

1. Liquid tight flexible non-metallic conduit (LFNC) shall be constructed of PVC. LFNC shall be UL listed. LFNC shall have an extruded moisture and oil-proof PVC jacket. LFNC shall be Ultratite Type NM as manufactured by Southwire, Type NM as manufactured by Electri-Flex, Anaconda Type NMUA by Anamet Electrical, Inc., or equal.
2. Watertight connectors shall be used with liquid tight flexible non-metallic conduit on both ends. LFNC shall be used to connect all vibrating equipment installed in sodium hypochlorite storage and transfer areas as specified herein, and other applications as directed by the Engineer or as indicated on the drawings.

G. Rigid Nonmetallic Conduit

1. Rigid nonmetallic conduit shall be Schedule 40 polyvinyl chloride (PVC), 90°C, UL rated and shall conform to NEMA TC 2. Fittings and conduit bodies shall conform to NEMA TC3.
2. Rigid non-metallic conduit shall be as manufactured by Carlon, Triangle Conduit and Cable, Cantex, Inc., or equal.

H. PVC Coated Metallic Conduit

1. PVC coated rigid steel conduit shall be furnished and installed as specified herein and indicated on the Drawings. The product shall be rigid galvanized steel conduit covered with a bonded 40 mil (minimum) thickness PVC jacket and coated inside with urethane. The conduit shall comply with NEMA RN-1 and shall be "Plasti-Bond Red" as manufactured by Robroy Industries, "OCAL-Blue" as manufactured by Thomas & Betts, Perma-Cote Supreme by Perma-Cote Industries, Kor Kap equivalent, or equal.

I. Electrical Metallic Tubing

1. Electrical metallic tubing shall meet ANSI C80.3 and shall be UL listed. The conduit shall be furnished and installed in accordance with Article 358 of the NEC. Electrical metallic tubing shall be manufactured by LTV Steel Tubular Products Company, "Electrunite", Triangular PWC, Inc., Allied Tube and Conduit Corporation, or equal.
2. The conduit shall be cold rolled steel tubing with a zinc coating on the outside and protected on the inside by a zinc, enamel, or equivalent corrosion resistant coating and conforming to the requirements of ANSI C 80.3, latest edition.

J. Conduit Fittings

1. Fittings for all conduit types shall conform to UL 467 and UL 514 as applicable.
2. Fittings for electrical metallic tubing shall be rain-tight and concrete-tight and shall be plated steel hexagonal threaded compression type.
3. Set screw or indenter type connectors shall not be used. Fittings for conduit installed in wet locations and underground shall provide a watertight joint. Fittings for rigid conduit shall be threaded.
4. Fittings or bushings shall be installed in easily accessible locations.
5. Where exposed conduits pass across structural expansion joints, approved weatherproof telescopic type expansion fittings shall be used. Fittings shall be OZ/GEDNEY Type AX, Crouse-Hinds Type XJG, or equal, watertight, and permit movement up to 4 inches. Each fitting shall be equipped with approved bonding jumpers around or through each fitting.
6. Where embedded conduits pass through expansion joints, approved watertight, concrete-tight deflection/expansion fittings shall be used. Fittings shall compensate for movement of 3/4-inch from the normal in all directions. Fittings shall be OZ/GEDNEY Type DX, Crouse-Hinds Type XD, or equal.
7. Conduit fittings ("condulets") shall be used on exposed conduit work for changes in direction of conduit runs and breaking around beams. "Condulets" shall be cast ferrous alloy, galvanized or cadmium plated, as manufactured by Crouse Hinds, OZ/Gedney, Appleton Company, or equal. Coated fittings and boxes shall be used with coated conduit in all chemically aggressive areas or where called for on the Drawings. Covers shall be of a design suitable for the purpose intended. In damp areas, the outside condulets shall be made watertight. Install all condulets with the covers accessible. Use proper tools to assemble conduit system to prevent injury to the plastic covering. No damage to the covering shall be permitted.
8. Conduit fittings shall be cast type of non-ferrous metal or malleable iron thoroughly coated inside and outside with metallic zinc or cadmium after all machining has been completed. Cast fittings shall be provided with heavy threaded hubs to fit the conduit required. Covers shall be of the same material as the fittings to which they are attached and shall be screwed on with rubber or neoprene gaskets between the covers and fittings. Cast fittings 1 1/2 inches and above shall be of the "mogul" type.
9. PVC coated fittings shall be used with PVC coated conduit. All conduit nipples, elbows, couplings, boxes, fittings, unions, expansion joints, connectors, bushing, and other components of the raceway system shall be factory coated to maintain the corrosion-resistant integrity of the conduit system. The coated conduit and its respective components shall all be provided by the same manufacturer. Coated conduit shall be used in all areas specified herein or indicated on the Drawings.
10. Conduit seals shall be Type EYS as manufactured by Crouse-Hinds, Appleton equivalent, OZ/Gedney equivalent, or equal.

PART 3 EXECUTION

3.01 CONDUIT AND FITTINGS

- A. Unless otherwise specified herein or indicated on the Drawings, the minimum size conduit shall be 3/4 inch for exposed work and 1 inch for conduit encased in concrete or mortar. Multiple circuits may not be combined in the same conduit without the explicit written permission to do so by the Engineer.

- B. Conduit home runs for lighting circuits are not necessarily indicated on the Drawings; however, the circuit numbers are shown. Conduit shall be furnished and installed for these lighting circuits and shall be installed as required to suit field conditions, subject to review and acceptance by the Engineer.
- C. Conduit shall be installed concealed unless otherwise indicated or specified. Conduit may be run exposed on walls only where concealing is not practical, or at the direction of the Engineer.
- D. Where exposed, maintain a minimum distance of 6 inches from parallel runs of flues or water pipes. Conduit runs shall be installed in such locations as to avoid steam or hot water pipes. A minimum separation of 12 inches shall be maintained where conduit crosses or parallels hot water or steam pipes.
- E. A non-metallic raceway containing instrumentation cable (if specifically allowed herein) where installed exposed shall be installed to provide the following clearances:
 - 1. Raceway installed parallel to raceway conductors energized at 480 through 208 volts shall be 18 inches and 208/120 volts shall be 12 inches.
 - 2. Raceway installed at right angles to conductors energized at 480 volts or 120/208 volts shall be 6 inches.
- F. Where practical, exposed raceways containing instrumentation cable shall cross raceway containing conductors of other systems at right angles.
- G. For floor mounted equipment, conduit may be installed overhead and dropped down, where underfloor installation is not practical. Groups of conduits shall be uniformly spaced, where straight and at turns. Conduit shall be cut with a hacksaw, or an approved conduit cutting machine and reamed after threading to remove all burrs. Securely fasten conduit to outlets, junction and pull boxes to effect firm electrical contact. Join conduit with approved couplings. Conduits shall be freed from all obstructions.
- H. Empty conduit systems shall be furnished and installed as indicated on the Drawings and shall have pull ropes installed. The polyethylene pull ropes shall be $\frac{1}{4}$ " diameter, minimum. Not less than 12 inches of slack shall be left at each end of the pull rope.
- I. Each piece of conduit installed shall be free from blisters or other defects. Each piece installed shall be cut square, taper reamed, and a coat of galvanizing and conducting compound shall be applied to the threads. Galvanizing compound shall be CRC Zinc-It or equal. Threads on conduits shall be painted with a conducting compound prior to making up in a fitting. Conduit connections shall be made with standard coupling and the ends of the conduit shall butt tightly into the couplings. Where standard coupling cannot be used, Erickson three-piece couplings shall be used. Where conduits are installed in concrete, concrete-tight three-piece couplings shall be used.
- J. Conduit threaded in the field shall be of standard sizes and lengths.
- K. All bends shall be made with standard factory conduit elbows or field bent elbows. Field bending of conduit shall be done using tools approved for the purpose. Heating of conduit to facilitate bending is prohibited. Field bends shall be not less than the same radius than a standard factory conduit elbow. Bends with kinks shall not be acceptable.
- L. The number of directional changes in a conduit run shall be limited to less than 360 degrees in a continuous conduit run between pulling locations. Pull boxes and/or handholes shall be provided as required for the installation to minimize the required pulling tension. A pull box or handhole is required for conduit runs every 400ft or more than 270 degrees of conduit directional change.

- M. All conduit for fiber optic cable shall have a minimum bending radius of 16 inches. Final bending radius shall be determined by the fiber optic cable manufacturer.
- N. Unless otherwise specified herein, indicated on the Drawings, or required by the NEC, conduit shall be supported every 8 feet (minimum) and shall be installed parallel with or perpendicular to walls, structural members, or intersections of vertical planes and ceilings with right angle turns consisting of fittings or symmetrical bends. Conduits shall be supported within 1 foot of all changes in direction. Supports shall be approved pipe straps, wall brackets, hangers, or ceiling trapeze.
- O. Use temporary raceway caps to prevent foreign matter from entering.
- P. In no case shall conduit be supported or fastened to another pipe or installed to prevent the removal of other pipe for repairs. Fastenings shall be by expansion bolts on concrete; by machine screws, welded threaded studs, or spring-tension clamps on steel work. Powder actuated fasteners may only be used to make connections where the use of this equipment complies with safety regulations and for structures in Seismic Design Categories A or B unless the fasteners are approved for seismic use. Wooden plugs inserted in masonry and the use of nails as fastening media are prohibited. Threaded C clamps may be used on rigid steel conduit only. Conduits or pipe straps shall not be welded to steel.
- Q. The load applied to fasteners shall not exceed 1/4 of the proof test load. Fasteners attached to concrete ceilings shall be vibration and shock resistant. Holes cut to a depth of more than 1 1/2 inches in reinforced concrete beams or to a depth of more than 3/4 inch in concrete joints shall not cut the main reinforcing bars. Holes not used shall be filled. Spring steel fasteners are not permitted. Conduits shall be fastened to all sheet metal boxes and cabinets with two (2) locknuts where required by the National Electrical Code to ensure adequate bonding for grounding. Where insulated bushings are used, or where bushings cannot be secured firmly to the box or enclosure, a bonding jumper shall be installed to maintain suitable grounding continuity. Locknuts shall be the type with sharp edges for digging into the wall of metal enclosures. Bushings shall be installed on the ends of all conduits and shall be of the insulating type where required by the National Electrical Code.
- R. Conduit installed in concrete floor slabs or walls shall be located so as not to affect the designed structural strength of the slabs. Conduit shall be installed within the middle one third of the concrete slab except where necessary to not disturb the reinforcement. The outside diameter of conduit shall not exceed one third of the slab thickness, and conduits shall be spaced no closer than three (3) diameters except at cabinet locations. Curved portions of bends shall not be visible above the finish slab. Where embedded conduits cross expansion joints, suitable expansion/deflection fittings and bonding jumpers shall be provided. Conduit larger than 1 inch trade size shall be parallel with or at right angles to the main reinforcement. When at right angles to the reinforcement, the conduit shall be close to one of the supports of the slab. Conduits shall not be stacked more than two (2) diameters high in floor slabs. Embedded conduits shall be placed in accordance with the latest edition of ACI-318 and coordinated with the STRUCTURAL Engineer.
- S. Install polyvinyl chloride (PVC) coated steel conduits when entering or exiting concrete except under electrical equipment where the conduit is not subject to physical abuse. Also install PVC coated steel conduit when transitioning between grade and a structure or an equipment stand. Extend stub-ups at least 12 inches above and below grade or finish floor. Conduits extending through the concrete floor shall be installed using straight runs (for vertical penetrations) or factory elbows (for conduits installed within the slab) of PVC coated rigid steel conduit.
- T. Aluminum conduits shall not be in contact with concrete surfaces. Where aluminum conduits are routed along concrete surfaces, they shall be installed with one hole cast straps with clamp-backs to space the conduit 1/4" away from concrete surface. Where aluminum conduit passes through

concrete, CMU or brick walls, the penetration shall be made such that the aluminum conduit does not come in contact with concrete, CMU, brick, or mortar. All penetrations shall meet or exceed the UL design standards. Aluminum conduit shall transition to PVC coated steel conduit where entering a concrete encasement, floor or ductbank.

- U. All conduit extending through the floor behind panels or into control centers or similar equipment may be PVC Schedule 40 and shall extend a minimum of 6 inches above the floor elevations, where practicable, with no couplings at floor elevations.
- V. Unless specifically identified on the Drawings as "Direct Buried," all conduits in the earth, including conduits below slabs-on-grade, shall be concrete encased. Joints in conduit shall be staggered so as not to occur side by side. Rigid non-metallic (PVC) conduit shall be connected to PVC coated rigid steel conduit at the point where it leaves the ground, with the transition to metal conduit occurring inside the concrete encasement.
- W. No more than three (3) 90-degree bends will be allowed in any one conduit run. Where more bends are necessary, a conduit or pull box shall be installed. All bends in 3/4-inch conduit shall be made with a conduit bender, and all larger sizes shall have machine bends. Joints in threaded conduit shall be made up watertight with the appropriate pipe thread sealant or compound applied to male threads only; and all field joints shall be cut square, reamed smooth, and properly threaded to receive couplings. No running threads are permitted. All conduit ends at switch and outlet boxes shall be fitted with an approved locknut and bushing forming an approved tight bond with box when screwed up tightly in place.
- X. Conduits stubbed up through concrete floors for connections to freestanding equipment and for future equipment shall be provided with an adjustable top or coupling threaded inside for plugs, set flush with the finished floor. Screwdriver operated threaded flush plugs shall be installed in conduits from which no equipment connections are made.
- Y. Where outlets are shown near identified equipment furnished by this or other Contractors, it is the intent of the Specifications and Drawings that the outlet be located at the equipment to be served. The Contractor shall coordinate the location of these outlets to be near the final location of the equipment served whether placed correctly or incorrectly on the Drawings. Changes in outlet locations required to serve the equipment furnished by other Contractors on the Project shall be brought to the attention of the Engineer.
- Z. Conduit shall be protected immediately after installation by installing flat noncorrosive metallic discs and steel bushings, designed for this purpose, at each end. Discs shall not be removed until it is necessary to clean the conduit and install the conductors. Before the conductors are installed, insulated bushings shall be installed at each end of the conduit.
- AA. Where "all-thread" nipples are used between fittings and electrical equipment, they shall be so installed that no threads are exposed.
- BB. Connections from rigid conduit to motors and other vibrating equipment, limit switches, solenoid valves, level controls, and similar equipment, shall be made with short lengths of liquid tight flexible metal conduit. These conduits shall be installed in accordance with the NEC and shall be furnished and installed with appropriate connectors with devices which will provide an excellent electrical connection between the equipment and the rigid conduit for the flow of ground current. Flexible metal conduit and liquid-tight flexible metal conduit length shall be three (3) feet, maximum.
- CC. Flexible metal conduit or liquid-tight flexible metal conduit installed between rigid metal conduit and motor terminal box and/or any other apparatus shall have a green insulated grounding conductor running through the flexible conduit. This conductor shall be terminated to the nearest

pull box, motor terminal box, or any other apparatus ground terminal. Flexible metal conduit and liquid-tight flexible metal conduit shall be grounded and bonded per NEC Articles 348 and 350, respectively.

- DD. Conduits installed within or underneath floor slabs, underground direct-buried or concrete encased conduits, and all conduits installed in areas subject to liquid inadvertently entering the conduit system shall be sealed or plugged at both ends in accordance with NEC Article 300-5(g). This requirement applies to both conduits containing conductors and "spare" conduits. Where practicable, the interior of the conduit shall be sealed as well as around the conductors by using conduit sealing bushings: Type CSB as manufactured by O/Z Gedney, or equal. Where the conduit fill does not allow the use of these bushings, the conduits shall be tightly caulked or plugged.
- EE. Conduit passing through the walls and floors of buildings below grade shall be installed with appropriate watertight fittings to prevent the entrance of ground water around the periphery of the conduits. For vertical conduit penetrations through openings in concrete floors, the fittings shall be Type FSK Floor Seals as manufactured by OZ/Gedney. For conduit penetrations through openings in concrete walls, the fittings shall be Type WSK Thruwall seals as manufactured by OZ Gedney. Conduits shall be sloped away from the buildings toward splice boxes, handholes and/or manholes to provide drainage away from the building wall.
- FF. Conduits passing through sleeves in interior walls and floors shall be tightly caulked.
- GG. Weatherproof, insulated throat "Meyers" hubs shall be used on all conduit entries to boxes and devices without integral hubs in process areas to maintain NEMA 3R or NEMA 4X integrity. The Contractor shall furnish and install "Meyers" hubs on all conduit entries into non-cast enclosures such as metallic or non-metallic control panels, control component enclosures, wireways, pull boxes, junction boxes, control stations, and similar type equipment when this type of equipment is located in process areas requiring NEMA 3R or NEMA 4X integrity. This specified requirement for "Meyers" hubs does not apply to any area of the plant facilities where NEMA 3R or NEMA 4X integrity is not required.
- HH. The use of two (2) locknuts, one on each side of the enclosure, and a grounding bushing shall be required at all conduit terminations where hub type fittings are not required, such as electrical rooms, control rooms, and office areas.
- II. Conduit installation shall be arranged to minimize cleaning. No horizontal runs of conduit will be permitted in brick or masonry walls.
- JJ. Install non-metallic conduits in accordance with manufacturer's instructions where specified herein or indicated on the Drawings.
- KK. Join non-metallic conduit using cement as recommended by the manufacturer. Clean and wipe non-metallic conduit dry before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for twenty (20) minutes (minimum).
- LL. All PVC coated conduit shall be installed in accordance with manufacturer's instructions. The Contractor shall use tools that are specifically suited for coated conduit systems. The use of pipe wrenches and other such tools on PVC coated RGS conduit is prohibited. The Engineer and Owner reserve the right to reject any installation of coated conduit that does not meet the requirements of the Section or the manufacturer's instructions. The Engineer and Owner also reserve the right to reject any installation that exhibits damage due to the improper use of tools. All rejected installations shall be replaced by the Contractor at no additional cost to the Owner. The use of PVC coated conduit repair compounds to repair damages or improper installation is prohibited.

- MM. All Contractor personnel that install PVC coated RGS conduit shall be trained by the PVC coated RGS conduit manufacturer. Training shall include proper conduit system assembly techniques, use of tools appropriate for coated conduit systems, and field bending/cutting/threading of coated conduit. The Contractor shall furnish evidence of such training as specified herein. Training shall have been completed within the past 24 months prior to the Notice to Proceed on this Contract for all coated conduit installation personnel. Contractor personnel not trained within this timeframe shall not be allowed to install coated conduit or shall be trained/re-trained as required prior to commencement of conduit installation.
- NN. Conduits shall not penetrate the floors or walls inside liquid containment areas unless specifically accepted by the Engineer.
- OO. All conduits that are buried or encased in concrete that transition from the ground to any stationary structure or equipment shall be equipped with a longitudinal expansion coupling capable of at least four inches of expansion. Conduits with encasement that is rigidly tied to the stationary structure in accordance with the Standard Details shall not be required to have expansion couplings.
- PP. Raceways shall not be installed concealed in water-bearing walls and floors.

3.02 CONDUIT USES AND APPLICATIONS

- A. No PVC conduit shall be installed exposed unless specifically accepted in writing by the Engineer. Where PVC conduit is allowed to be installed exposed, the conduit shall be Schedule 80.
- B. PVC Schedule 80 conduit shall be furnished and installed in concrete slabs (for slab-on-grade construction) and in walls when the conduit is shown to be encased. Rigid steel conduit shall be installed in all elevated slabs when the conduits are shown to be encased.
- C. PVC Schedule 80 conduit shall be installed in reinforced concrete encasement. Conduit shall be "direct buried" only if specifically indicated on the Drawings.
- D. All instrumentation wire and cable for analog signals shall be installed in rigid steel conduit or PVC coated rigid steel conduit to suit the application. This applies to all conduit installations including exposed, concealed in concrete encasement, and all other applications.
- E. PVC coated rigid steel conduit shall be furnished and installed, where exposed, in the following areas:
1. All outdoor locations.
 2. Pump rooms.
 3. Wet-Process Areas
 4. Vaults
- F. Liquid-tight flexible non-metallic conduit (LFNC) shall be furnished and installed, where required, in chemical storage and transfer areas.
- G. Other conduit uses not specifically listed above shall be brought to the attention of Engineer for a decision.
- H. Electric Metallic Tubing (EMT) style conduit is not permitted without special approval by the Engineer.

3.03 CONDUIT IDENTIFICATION

- A. Conduits shall be provided with type 316 stainless steel, laser etched conduit tags. Tags shall be permanently fastened with stainless steel straps. Conduit identification as indicated on the drawings.
- B. The identification system for the conduits furnished and installed under this Contract shall match the existing identification system used at the facility.

3.04 TESTING

- A. All tests shall be performed in accordance with the requirements of the General Conditions. The following tests are required:
 - 1. Field Tests
 - a. Field testing shall be done in accordance with the requirements specified in the General Conditions and Section 26 05 00, Common Work Results for Electrical.
 - b. All conduit installed below grade or concrete encased shall be tested to ensure continuity and the absence of obstructions by pulling through each conduit a swab followed by a mandrel 85% of the conduit inside diameter. After testing, all conduits shall be capped after installation of a suitable pulling tape.

END OF SECTION

SECTION 26 08 00

COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions Specification Sections, apply to Work of this Section. Should there be any conflict between provisions or requirements elsewhere indicated and the provisions of this division, request written clarification by addendum prior to submission of bid or abide by the interpretation of the Engineer.

1.02 SUMMARY

- A. This section specifies the acceptance testing of electrical materials, equipment, and systems. Contractor shall provide all labor, tools, material, power, and other services necessary to provide the specified tests.

1.03 REFERENCES

- A. General: This section contains references to the International Electrical Testing Association (NETA), ATS-2013: Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems, copyright 2013. It is a part of this section as specified and modified. In case of conflict between the requirements of this section and those of said document, the requirements of this section shall prevail.
- B. Safety and Procedural Requirements:
 - 1. Safety and Precautions: This specification does not include specific safety procedures. It is recognized that tests and inspections set forth by this specification may be potentially hazardous. Consequently, individuals performing these tests must be capable of conducting these tests in a safe manner and with complete knowledge of the hazards involved. Each person involved in this project must be provided with and use appropriate personal protective equipment.
 - 2. Safety practices that shall be followed include, but are not limited to, the following:
 - a. Occupational Safety and Health Act.
 - b. Accident Prevention Manual for Industrial Operations, National Safety Council.
 - c. Applicable state and local safety operating procedures.
 - d. Owner's safety practices.
- C. Perform all testing work in accordance with the applicable codes and standards of the following agencies except as provided otherwise herein:
 - 1. International Electrical Testing Association – NETA Acceptance Testing Specifications (ATS).
 - 2. National Fire Protection Association.
 - 3. National Electrical Code, ANSI/NFPA 70.
 - 4. Recommended Practice for Electrical Equipment Maintenance, ANSI/NFPA 70B.
 - 5. Electrical Safety Requirements for Employee Workplaces, NFPA 70E.

1.04 APPLICATION

- A. General: Requirements for testing in accordance with this section are specified in this and other sections of Division 26. Where testing in accordance with this section is required, the required tests, including correction of defects where found, and subsequent retesting, shall be completed prior to energization of material, equipment, or systems.

1.05 SUBMITTALS

- A. General: Submit the following in accordance with the requirements of Specification 26 05 00.
1. Description of all test procedures.
 2. Examples of test report forms for all specified tests including deficiency report forms.
 3. Final test report.
 4. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (in the margin adjacent to the beginning of the paragraph) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph. The remaining portions of the paragraph not underlined will signify compliance on the part of the Contractor with the specifications. The submittal shall be accompanied by a detailed, written justification for each deviation. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 5. Submittal Presentation: Submittal data shall be assembled in folders or three-ring binders. Each folder or binder shall contain a cover sheet, indexed by item, and cross-referenced to the appropriate specification paragraph. Catalog cuts shall be edited to show only the items, model numbers, and information that applies to the equipment being furnished.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT AND MATERIALS

- A. General: Test instruments shall be calibrated to references traceable to the National Institute of Standards and Technology and shall have a current sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required.
- B. NETA Compliance: Test equipment shall be in complete compliance with ATS-2013, Paragraphs 5.2 and 5.3.

PART 3 EXECUTION

3.01 GENERAL

- A. The test procedures to be conducted by the Installing Contractor are defined as those tests specified in paragraph 26 08 00-3.4 B.

3.02 TEST DOCUMENTATION

- A. Inspection and Test Procedures Documentation: Test procedure documentation shall be submitted in accordance with paragraph 26 08 00-1.5.
- B. Test Report Forms: The test report forms are appended to the end of this section.
- C. Reports: Deficiency reports shall be prepared for each item under test and submitted to the Engineer at the end of each day of testing. Deficiency reports shall identify the equipment under test by tag number and location and shall describe all deficiencies observed through the course of inspection and testing.

3.03 EQUIPMENT TESTING

- A. General: The inspection and test procedures described by ATS-2013, Section 7 shall establish the minimum requirements for electrical equipment inspection and testing. Additional test procedures, beyond the scope of ATS-2013, Section 7, are defined herein and shall be conducted as specified.
- B. Installing Contractor Tests: The following types of equipment and/or systems shall be inspected and tested by the installing contractor:
 - 1. Insulation Resistance Tests: Insulation resistance tests shall be performed on the following types of equipment or systems:
 - a. Low Voltage (600 volt maximum) Power and Control Conductors and Cables: Insulation resistance tests shall be performed on all circuits 120 volts and above except interior lighting and 120-volt receptacle circuits.
 - 1) Power and control conductor and cable insulation tests shall be performed in accordance with ATS-2013, Paragraph 7.3.2. Tests may be conducted with motors and other equipment connected, except that solid-state equipment shall be disconnected unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.
 - 2) The ambient temperature at which insulation resistance is measured shall be recorded on the test form.
 - 3) Test results shall be evaluated against the results for cables of same type and length. Test results of less than 50 mega-ohms shall be investigated.
 - b. Signal Cables: All analog signal cables shall be tested as specified herein.
 - 1) The loop resistance of each signal pair or triad shall be measured. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory. For pairs with greater than 50-ohm loop resistance, the Contractor shall calculate the expected loop resistance considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.
 - 2) Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad.
 - 3) Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

- 4) Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500-volt megohmmeter shall be used for insulation resistance measurements.
 - c. Test Records: Insulation resistance measurements shall be recorded on test report forms in compliance with specification 26 05 19.
 2. Pre-functional Checkout: Functional testing shall be performed in accordance with the requirements of this specification. Prior to functional testing, all protective devices shall be adjusted and made operative. Prior to energization of equipment, all system component tests shall be completed, and the Contractor shall perform a functional checkout of the control circuit. Checkout shall consist of energizing each control circuit and operating each control, alarm or malfunction device and each interlock in turn to verify that the specified action occurs. The Contractor shall submit a description of his proposed functional test procedures prior to the performance of functional checkout.
 - C. Witnessing
 1. The Engineer reserves the right to observe all Contractor testing. The Engineer shall be notified five (5) days prior to testing.
- 3.04 TEST RESULTS
- A. General: Minimum acceptable test values shall be as specified in this specification and ATS-2013. Where acceptable test values are not specified, the equipment manufacturers recommended test values shall be used.

END OF SECTION

SECTION 26 09 16

ELECTRICAL CONTROLS AND RELAYS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish, install, test, and place in satisfactory operation all electric controls and relays as specified herein and indicated on the Drawings.
- B. Electrical control and relay systems shall be assembled using NEMA rated components. Components designed and built to International Electrotechnical Commission (IEC) standards are not recognized. Equipment designed, manufactured, and labeled in compliance with IEC standards is not acceptable.

1.02 REFERENCED SECTIONS

- A. General Conditions – COORDINATION AND MEETINGS
- B. General Conditions – SUBMITTALS
- C. Section 260500 – COMMON WORK RESULTS FOR ELECTRICAL
- D. Section 260526 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

1.03 REFERENCES

NEMA 250	Enclosures for Electrical Equipment
UL 508A	Standard for Industrial Control Panels
UL-1203	Standard for Explosion-proof and Dust-ignition-proof Electrical Equipment for use in Hazardous (Classified) Locations.
ANSI/ISA	NonIncendive Electrical Equipment for use in Class I and II, Division II Hazardous (Classified) locations.
UL 489	Molded Case Circuit Breakers, Molded Case Switches, and Circuit Breaker Enclosures

1.04 ACTION SUBMITTALS

- A. Submittals shall be in accordance with the General Conditions, and as specified herein.
- B. Product Datasheets.
- C. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is

not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.

1.05 INFORMATION SUBMITTALS

- A. Submittals shall be in accordance with the General Conditions, and as specified herein.
- B. Prior to start-up, submit manufacturer's operation and maintenance manuals and recommended spare parts list, including but not limited to:
 - 1. Manufacturer's equipment warranty.
 - 2. Copies of Submittals
 - 3. Functional descriptions, operating instructions, calibration and adjustment, recommended maintenance, safety
 - 4. Contact information for local representative and supplier

1.06 TOOLS AND SPARE PARTS

- A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor. In addition to the manufacturer recommended spare parts, the following spare parts shall be provided for the local control stations:
 - 1. One (1) contact block of each type furnished on the project
 - 2. One (1) indicating light lens of each color furnished on the project
 - 3. One (1) LED lamp of each color furnished on the project
 - 4. One (1) Control Relay of each type furnished on the project
 - 5. One (1) Timing Relay of each type furnished on the project
 - 6. One (1) Contact and Coil Kit for each type of motor starter furnished on the project
- B. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.
- C. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.
- D. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.
- E. Parts shall be completely identified with a numerical system to facilitate parts control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same part number.

PART 2 - PRODUCTS

2.01 CONTROL COMPONENTS

A. Pilot Devices

1. General

- a. All pilot devices shall be provided with a legend plate. Legend plates shall have a white background and black lettering and indicate the function of the respective pilot device. The text shown on the Drawings or indicated in the specifications shall be used as the basis for legend plate engraving (i.e., HAND-OFF-AUTO, RUN, EMERGENCY STOP, etc.).
- b. All pilot devices shall be selected and properly installed to maintain the NEMA 250 rating of the enclosure in which they are installed. All pilot devices shall be UL 508 Listed.
- c. All pilot devices shall be 30.5mm in diameter, unless otherwise indicated. 22mm devices are not acceptable.
- d. Pilot devices for all electrical equipment under this Contract shall be of the same type and manufacturer unless otherwise specified herein or indicated on the Drawings.
- e. In Class I Division 2 hazardous locations, pilot devices shall be the hermetically sealed type, constructed in accordance with ANSI/ISA.

2. Pushbuttons

- a. Pushbuttons shall be non-illuminated, black in color, and have momentary style operation unless otherwise indicated on the Drawings.
- b. Pushbuttons shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each pushbutton. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.
- c. Pushbuttons shall be provided with a full guard around the perimeter of the button. Where a lockout style pushbutton is specified or indicated on the Drawings, provide a padlock-able guard.

3. Selector Switches

- a. Selector switches shall be non-illuminated, black in color, and have the number of maintained positions as indicated on the Drawings and as required. Handles shall be the extended type that provide a greater surface area for operation.
- b. Selector switches shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each selector switch. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.
- c. Where indicated in the Drawings or Specifications, provide spring return positions.

- d. Selector switches shall be provided with an indexing component that fits into the keyed portion of the cutout for the device and prevents the switch from spinning when operated.

4. Indicating Lights

- a. Indicating lights shall LED type, with the proper voltage rating to suit the application, and push-to-test feature.
- b. Indicating light lens colors shall be as required in equipment specifications and/or as indicated on the Drawings. If lens colors are not indicated, the following colors shall be used:

Red	"Run", "On", "Open"
Green	"Off", "Closed"
Amber	"Alarm", "Fail"
White	"Control Power On"
Blue	General Status

5. Emergency Stop and Tagline Switches

- a. Emergency stop switches shall be non-illuminated, red in color, with a minimum 35mm diameter mushroom head. Once activated, switch shall maintain its position and require a manual pull or twist to release/reset.
- b. Tagline switches shall have a plunger that activates upon tension from the associated safety cable. Once activated, switch shall maintain its position and require a manual release/reset.
- c. Emergency stop and tagline switches shall have the quantity of normally closed and/or normally open contacts as indicated on the Drawings and as required. In addition to the required contacts, one (1) spare normally open and one (1) spare normally closed contact shall be installed at each switch. Contacts shall be rated for 5A at 250VAC/DC (minimum), but no less than required for the application.

B. Relays and Timers

1. General

- a. Relays and timers shall be furnished with an integral pilot light for positive indication of coil energization.
- b. Relays and timers shall have tubular pin style terminals with matching 11-pin DIN rail mount socket. Spade or blade style terminals are not acceptable.
- c. Relays and timers for all electrical equipment under this Contract shall be of the same type and manufacturer unless otherwise specified herein or indicated on the Drawings.

- d. Relays and timers shall fit a standard 11-pin tubular pin socket.
2. Control and Pilot Relays
- a. Miniature or "ice-cube" type relays are not acceptable.
 - b. Relays shall have coil voltage as required to suit the application and/or as indicated on the Drawings.
 - c. Relays shall be provided with contacts rated for 10A (resistive), minimum, at 120/240 VAC and 28 VDC. Relays shall have 3-pole, double-throw (3PDT) contact arrangement.
3. Time Delay Relays
- a. Timers delay relays shall utilize electronic timing technology. Mechanical or thermal timing devices are not acceptable.
 - b. Relays shall have coil voltage as required to suit the application and/or as indicated on the Drawings.
 - c. Relays shall be provided with contacts rated for 10A (resistive), minimum, at 120/240 VAC and 28 VDC. Relays shall have double-pole double-throw (DPDT) contact arrangement.
 - d. Time delay ranges shall be as indicated on the Drawings and/or as required to suit the application. Timing range shall be adjustable from the front of the relay. On delay and off delay timer configurations shall be provided as indicated on the Drawings and/or as required to suit the application.
4. Elapsed Time Meters
- a. Elapsed time meters shall be non-resettable type with no less than a 6-digit display. Coil voltage shall be as required to suit the application and/or as indicated on the Drawings.
- C. Control Terminal Blocks
- 1. Control terminal blocks shall be assembled on non-current carrying galvanized steel DIN mounting rails securely bolted to the enclosure or subpanel. Terminals shall be tubular screw type with pressure plate that will accommodate wire size range of #22 - #8 AWG.
 - 2. Control terminal blocks shall be single tier with a minimum rating of 600 volts and 20A. Separate terminal strips shall be provided for each type of control used (i.e., 120VAC vs. 24VDC). Quantity of terminals shall be provided as required to suit the application. In addition, there shall be enough terminals for the termination of all spare conductors.
 - 3. Terminals shall be marked with a permanent, continuous marking strip, with each terminal numbered. One side of each terminal shall be reserved exclusively for incoming field conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal.

2.02 MOTOR STARTERS

- 1. Motor starters shall conform to NEMA Standard IC1 and shall be for across-the-line starting,

unless otherwise indicated. IEC rated equipment is not acceptable and shall be used as a basis for rejection of the equipment. The size of the starter shall be as required for the particular load. Minimum starter size shall be NEMA Size 1.

2. A suitable control disconnect device(s) to comply with the requirements of the NEC shall be provided.
3. Magnetic starters and contactors shall be electromagnetic vertical or horizontal lift design with double break cadmium oxide silver contacts. Design shall meet or exceed the requirements of UL and NEMA Standards. Coils shall be hot molded construction to protect the coils from mechanical and environmental damage. Contacts and coils shall be replaceable without replacing the entire starter assembly.
4. Each starter shall be able to accommodate a minimum of three (3) auxiliary contacts in addition to the hold-in contact.
5. Each starter shall be supplied with a 3 pole, manual reset overload relay. The relays shall be solid state type, with at least one isolated normally open and one isolated normally closed auxiliary contact that operates when a trip condition has occurred. Relays shall be self-powered, have a visible trip indicator, have a trip test function, and have selectable Class 10 or 20 operation. Overload relays shall be set for Class 10 operation unless otherwise directed by the Engineer. Overload relay shall have phase loss protection built in to trip the unit and protect the motor against single phasing. The Contractor shall provide the overload relay model with the correct current range for each application. Overload relay shall have adjustable current range dial. Eutectic alloy or bi-metallic type overload relays are not acceptable.
6. Each motor starter coil shall be equipped with a surge-suppression device for protection of the solid-state equipment (e.g., programmable logic controller) wired as part of the control circuit.
7. The minimum control power transformer VA requirements are shown below. Control power transformers shall be sized as required for the connected loads, plus 25% spare capacity.

Size 1	75 VA
Size 2	75 VA
Size 3	200 VA
Size 4	300 VA
Size 5	500 VA
8. The Contractor is advised to review the Contract Documents for additional requirements for space heaters, power factor correction capacitors, and similar equipment which may not be specified in this Division or shown on the Drawings. Control power transformers shall be fused or circuit breaker protected on both the primary and secondary sides as shown on the Drawings.

2.03 CIRCUIT BREAKERS

- A. Circuit breakers shall be molded case type with trip and frame ratings as indicated on the Drawings. Provide electronic trip unit where indicated on the Drawings, with adjustable functions as indicated on the Drawings. Provide adjustable instantaneous trip for all circuit breakers rated 100 amps or greater.
- B. The Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

- C. Circuit breakers shall have an interrupting rating of 65,000 amperes symmetrical at 480 VAC, unless otherwise indicated on the Drawings.
- D. Circuit breakers in non-hazardous locations shall be UL 489 Listed. Circuit breakers in hazardous locations shall be UL 1203 Listed.
- E. Circuit breakers shall be quick-make, quick-break and with an interlocked cover which cannot be opened when the breaker is in the "ON" position and capable of being locked in the "OPEN" position. An interlock defeat to allow opening while energized shall be provided.
- F. Where indicated on the Drawings, circuit breakers shall be 100% rated.
- G. Circuit breakers shall be NEMA style construction, IEC style circuit breakers are not acceptable.
- H. Manufacturer shall be:
 - 1. Square D Company (Schneider Electric)
 - 2. Eaton
 - 3. Siemens Energy and Automation
 - 4. Or Engineer Approved Equal

2.04 LOCAL CONTROL STATIONS

- A. Local control stations shall be furnished and installed complete with pushbuttons, selector switches, indicating lights, and other devices as indicated on the Drawings.
- B. Specific devices installed in local control stations shall be provided in accordance with the requirements specified elsewhere in this Section.
- C. In non-hazardous locations, local control stations shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Die Cast Zinc
Indoor Dry Non-process Area	NEMA 12, Die Cast Zinc
Chemical Storage/Transfer Area	NEMA 4X, Fiberglass or Thermoplastic Polyester
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

- D. In hazardous locations, local control stations shall be furnished with the following enclosure type and material of construction, dependent upon the classification of the area in which they are to be installed. Area classifications are indicated on the Drawings.

AREA CLASSIFICATION	ENCLOSURE TYPE AND MATERIAL
Class I, Division 1, Group D	NEMA 7, Die Cast Aluminum
Class I, Division 2, Group D	NEMA 4X, Type 304 Stainless Steel
Class II, Division 1, Group F	NEMA 9, Die Cast Aluminum
Class II, Division 2, Group F	NEMA 9, Die Cast Aluminum

- E. Non-metallic enclosures, NEMA 7 enclosures, and NEMA 9 enclosures shall be provided with threaded integral conduit hubs. Conduit hubs shall be external to the enclosure.
- F. Local control stations for use in non-hazardous locations shall be UL-508 Listed. Local control stations for use in Class I Division 1 and Class II Divisions 1/2 hazardous locations shall be UL-1203 Listed. Local control stations for use in Class I Division 2 hazardous locations shall be in accordance with ANSI/ISA.
- G. Provide a nameplate on each local control station in accordance with Basic Electrical (See Referenced Sections). The name and/or number of the equipment associated with each control station shall be engraved on the nameplate, followed by the words "LOCAL CONTROL STATION".

2.05 Manufacturer shall be:

- 1. Siemens Energy and Automation
- 2. Eaton
- 3. Square D (Schneider Electric)
- 4. Allen-Bradley
- 5. Or Engineer Approved Equal

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Local control stations shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.
- B. All control components shall be mounted in a manner that will permit servicing, adjustment, testing, and removal without disconnecting, moving, or removing any other component. Components mounted on the inside of panels shall be mounted on removable plates and not directly to the enclosure. Mounting shall be rigid and stable unless shock mounting is required otherwise by the manufacturer to protect equipment from vibration. Component's mounting shall be oriented in accordance with the component manufacturer's and industries' standard practices.
- C. Pilot devices shall be properly bonded to the equipment enclosure door where they are installed. If proper bonding cannot be achieved through the locknuts that affix the device in place, a green colored bonding screw shall be provided on the pilot device. The bonding screw shall be bonded to the equipment enclosure using an insulated green bonding conductor.
- D. Local control station covers shall be bonded to the local control station enclosure using an insulated green bonding conductor.
- E. Wiring to devices at each local control station shall be provided with enough slack to permit the local control station cover to be removed and pulled at least 6 inches away from the enclosure.
- F. Terminal strips, relays, timers, and similar devices shall not be installed on the rear of the panel/cabinet doors. Terminal strips, relays, timers, and similar devices shall not be installed on

the side walls of panel/cabinet interiors without written permission from the Engineer.

END OF SECTION

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SECTION 26 29 13

ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install separately mounted, individual motor controllers for 120 volt single phase, and 208 and 480 volt three phase motors as specified herein and indicated on the Drawings. Individual motor controllers specified in this Section include magnetic motor starter and manual motor starters

1.02 REFERENCED SECTIONS

- A. General Conditions – COORDINATION AND MEETINGS
- B. General Conditions - SUBMITTALS
- C. Section 260500 – COMMON WORK RESULTS FOR ELECTRICAL
- D. Section 260519 – LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLE
- E. Section 260916 – ELECTRIC CONTROLS AND RELAYS

1.03 REFERENCES

UL 508	Standard for Industrial Control Panels
NEMA 250	Enclosures for Electrical Equipment

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the General Conditions and the Contractor shall obtain from the equipment manufacturer and submit the following:
 - 1. Shop Drawings.
 - 2. Spare Parts.
 - 3. Reports of Certified Shop and Field Tests.
 - 4. Operation and Maintenance Manuals.
- B. Each submittal shall be identified by the applicable specification section.

1.05 ACTION SUBMITTALS

- A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

- B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.
- C. Shop drawings shall include but not be limited to:
 - 1. A Compliance, Deviations, and Exceptions (CD&E) letter. If the shop drawings are submitted without this CD&E letter, the submittal will be rejected. The letter shall include all comments, deviations and exceptions taken to the Drawings and Specifications by the Contractor AND Equipment Manufacturer/Supplier. This letter shall include a copy of this specification section. In the left margin beside each and every paragraph/item, a letter "C", "D", or "E" shall be typed or written in. The letter "C" shall be for full compliance with the requirement. The letter "D" shall be for a deviation from the requirement. The letter "E" shall be for taking exception to a requirement. Any requirements with the letter "D" or "E" beside them shall be provided with a full typewritten explanation of the deviation/exception. Handwritten explanation of the deviations/exceptions is not acceptable. The CD&E letter shall also address deviations, and exceptions taken to each Drawing related to this Specification Section.
 - 2. Product data sheets.
 - 3. Complete layout and installation drawings with clearly marked dimensions for each type/size/rating of individual motor controller.
 - 4. Custom wiring diagrams for each individual motor controller. Standard wiring diagrams that are not custom created by the manufacturer for the individual motor controllers for this project are not acceptable. One wiring diagram which is typical for an equipment group (e.g., reuse water pump) is not acceptable. Each wiring diagram shall include wire identification and terminal numbers. Indicate all devices, regardless of their physical location, on the diagrams. Identify on each respective wiring diagram specific equipment names and equipment numbers consistent with those indicated on the Drawings.
 - 5. Bill of material list for each individual motor controller.
 - 6. Nameplate schedule for each individual motor controller.
 - 7. Manufacturer's installation instructions.
 - 8. Time-current curves for each type and size protective device if requested by the Engineer.
- D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft-cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.
- E. Prior to completion and final acceptance of the project, the Contractor shall furnish and install "as-built" wiring diagrams for individual motor controller. These final drawings shall be plastic laminated and securely placed inside each individual motor controller unit door and included in the O&M manuals.

1.06 OPERATION AND MAINTENANCE MANUALS

- A. The Contractor shall submit operation and maintenance manuals in accordance with the procedures and requirements set forth in the General Conditions.

1.07 TOOLS AND SPARE PARTS

- A. All spare parts as recommended by the equipment manufacturer shall be furnished to the Owner by the Contractor.
- B. The Contractor shall furnish the following additional spare parts:

<u>No. Required</u>	<u>Description</u>
2 sets	Fuses of each size provided
1	Starter coil and complete set of contacts for each size and type of starter provided.
1	Relay of each size and type used.
1	Control power transformer of each size used.
1	Lamps and lenses for indicating lights, each color.
1	Indicating lamp sockets for each type used.
1	Pilot device (e.g., pushbutton, selector switch, etc.) complete with contact blocks and legend plates for each type, color, size, and rating used.
1	Motor circuit protector for each type, size, and rating used.
1	Molded case circuit breaker for each type, size, and rating used (except main circuit breakers).

- C. The spare parts shall be packed in containers suitable for long term storage, bearing labels clearly designating the contents and the pieces of equipment for which they are intended.
- D. Spare parts shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such spare parts until completion of the work, at which time they shall be delivered to the Owner.
- E. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.
- F. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size, shall have the same parts number.

1.08 IDENTIFICATION

- A. Each equipment item shall be identified with a nameplate. The nameplate shall be engraved with the equipment name and/or number with which it is associated. Equipment identification shall be in accordance with Common Work Results for Electrical (See Referenced Sections).

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.

2.02 INDIVIDUAL MAGNETIC MOTOR STARTERS

- A. Individual magnetic motor starters shall be combination type complete with motor circuit protectors (MCP's). Starters shall be rated 480 VAC, 3-pole, sized for the intended load unless otherwise indicated. In no case shall a starter smaller than a NEMA Size 1 be used. Each starter shall be furnished with a minimum of two spare auxiliary contacts. Only fully rated NEMA starters are acceptable. Fractionally stepped "half size" starters between full NEMA sizes are not permitted.
- B. Only NEMA starters with replaceable contacts and coils are permitted. NEMA-rated IEC starters are not acceptable.
- C. In non-hazardous locations, motor starters shall be furnished with the following enclosure type and material of construction, dependent upon the designation of the area in which they are to be installed. Area designations are indicated on the Drawings.

AREA DESIGNATION	ENCLOSURE TYPE AND MATERIAL
Indoor Wet Process Area	NEMA 4X, Type 304 Stainless Steel
Indoor Dry Process Area	NEMA 12, Painted Steel
Indoor Dry Non-process Area	NEMA 12, Painted Steel
Chemical Storage/Transfer Area	NEMA 4X, Fiberglass
All Outdoor Areas	NEMA 4X, Type 304 Stainless Steel

- D. Starters shall be provided with all coils and controls for 120 VAC operation, unless otherwise indicated on the Drawings.
- E. The minimum control power transformer VA requirements are as shown below. Control power transformers shall be sized as required for the connected loads, plus 25% spare capacity.

Size 1 75 VA

Size 2 75 VA

Size 3 200 VA

Size 4 300 VA

Size 5 500 VA

- F. The panel manufacturer is advised to review the total Contract Documents for additional requirements for space heaters, power factor correction capacitors, and similar equipment which may not be specified in this Division or shown on the Drawings. Control power transformers shall be protected on both the primary and secondary sides.
- G. Each starter shall be supplied with a manually resettable overload relay. Manual reset shall be accomplished by a door mounted overload reset pushbutton, as shown on Drawings. The relays shall be solid state type, with at least one isolated normally open and one isolated normally closed auxiliary contact that operates when a trip condition has occurred. Relays shall be self-powered, have a visible trip indicator, have a trip test function, and have selectable Class 10 or 20 operation. Overload relays shall be set for Class 10 operation unless otherwise directed by the Engineer. Overload relay shall have phase loss protection built in to trip the unit and protect the motor against single phasing. The Contractor shall provide the overload relay model with the correct current range for each application. Overload relay shall have adjustable current range dial. Eutectic alloy and bi-metallic type overload relays are not acceptable.
- H. Control Devices
 - 1. Furnish and install control devices as required and/or shown on the Drawings. The following control devices shall be provided as specified in Electric Controls and Relays (See Referenced Sections):
 - a. Pilot devices (switches, indicating lights, etc.)
 - b. Relays and timers
 - c. Control Terminal blocks
 - I. All control wiring shall be No. 14 AWG (minimum) labeled at each end in accordance with the wiring numbers shown on the accepted shop drawings. Power wiring shall be sized to suit the maximum horsepower rating of unit; No. 12 AWG (minimum). Wiring shall be type MTW rated for 105°C. Wire color coding shall be as specified in Low Voltage Wire and Cable (See Referenced Sections).
 - J. Each motor starter coil shall be equipped with a surge-suppression device for protection of the solid state equipment (e.g. programmable logic controller) wired as part of the control circuit.
 - K. Manufacturer shall be:
 - 1. Square D Company (Schneider Electric)
 - 2. Eaton
 - 3. Siemens Energy and Automation
 - 4. Or Engineer Approved Equal

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All individual motor starters shall be installed as indicated on the Drawings and as recommended by the equipment manufacturer.

- B. Individual motor starters shall be provided in the enclosure type and material of construction required for the area in which it is installed. Reference the requirements in Part 2 herein, and the area designations indicated on the Drawings.

3.02 TESTING

- A. All tests shall be performed in accordance with the requirements of the General Conditions. The following tests are required:
 - 1. Witnessed Shop Tests
 - a. None required.
 - 2. Field Tests
 - a. Field testing shall be done in accordance with the requirements specified in the General Conditions and NETA acceptance testing specifications, latest edition.

END OF SECTION

SECTION 31 05 00

EARTHWORK

PART 1 GENERAL

1.01 COPE OF WORK

- A. This Section specifies earthwork required to complete the work of the project as described in the Contract Documents, including, but not be limited to, excavating, removing, loading, transporting, placing, and compacting of all earthen materials and associated work and incidentals. Excavation for structures, pipelines, ponds and associated facilities.
- B. Backfilling under and around structures, backfilling of trenches and pits, construction of fills, embankments and pond liners.
- C. Sheeting and bracing, including, but not be limited to, the furnishing, placing, and removing of sheeting and bracing necessary to safely support the sides of all excavations and the supporting of structures above and below the ground during earthwork operations.
- D. Dewatering as necessary to complete the work, including but not limited to, all pumping, ditching, draining, and other required measures for the removal or exclusion of water from excavations.
- E. The disposal of excess excavated materials including handling and disposal of contaminated soils.
- F. Borrow from onsite locations or importation from off-site of suitable materials for various purposes as specified and to make up deficiencies for fills.
- G. Other incidental earthwork, as indicated on the drawings and as required for completion of the project.

1.02 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C117 – Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.
 - 2. ASTM C136 – Standard Method for Sieve Analysis of Fine and Course Aggregates.
 - 3. ASTM D75 – Standard Practice for Sampling Aggregates.
 - 4. ASTM D422 – Test Method for Particle-Size Analysis of Soils.
 - 5. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³ (600 kN-m/m³)).
 - 6. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - 7. ASTM D1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 8. ASTM D1633 – Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders.

9. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
10. ASTM D4253 – Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
11. ASTM D4254 – Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
12. ASTM D4318 – Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
13. ASTM D5084 – Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using A Flexible Wall Permeameter.
14. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth))
15. American Association of State Highway Transportation Officials (AASHTO) T272, Standard Method of Test for Family of Curves-One Point Method, in the Standard Specifications for Transportation Materials and Methods of Sampling and Testing, Part II, Testing.
16. Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction (CDOT Standard Specifications).

1.03 OSHA STANDARDS

- A. The Contractor's attention is directed to the latest provisions of Section 1926 of the OSHA Safety and Health Standards for Construction.

1.04 SUBMITTALS

- A. All submittals shall be in accordance with Section 01 33 00.
- B. At least 30 days prior to the start of excavation submit an Excavation Plan detailing:
 1. Methods and sequencing of excavations
 2. Numbers, types and sizes of proposed excavation equipment
 3. Control and removal of groundwater and stormwater from surface and excavations
 4. Proposed locations and configuration of stockpiles for excavated materials
- C. Copy of Colorado Department of Public Health & Environment Water Quality Construction General Permit.
- D. For all imported materials proposed to be used in the work submit:
 1. Certified test results documenting conformance with all specification requirements. Imported fill materials will be tested by Contractor's testing laboratory at the source prior to being transported to the site.
 2. Samples taken at the source. Sample sizes shall be as required by the testing laboratory.
- E. Submit means, methods and material specification for backfilling structures, pipe, and appurtenances to the limits shown on the Drawings. Include information on set time(s) and strength characteristics for controlled strength fill material, placement of bulkheads and methods for verifying fill quantities.

- F. Submit certified design of sloping, bracing, sheeting/shoring and support systems for excavations and trenches in accordance with OSHA requirements and other governing Laws and Regulations and including certification of the qualifications of the engineering design professional responsible for the design.

1.05 QUALITY ASSURANCE

- A. General: All soils testing will be performed by an Engineer and Owner approved testing laboratory of the Contractor's choice at the Contractor's expense. Copies of all test reports shall be sent to the Owner and Engineer at the same time they are sent to the Contractor.
- B. Where soil material is required to be compacted to a percentage of relative compaction, the maximum density at optimum moisture content will be determined in accordance with ASTM D698 or ASTM D1557 as indicated, except as otherwise stated in these Specifications. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D4253 and D4254. Field density in-place tests will be performed in accordance with ASTM D1556, ASTM D6938, or by other means acceptable to the Owner.
- C. When tests of fill or backfill show noncompliance with the required density, gradations, or other physical properties, Contractor shall take whatever actions are necessary and as may be required to remedy any deficiencies and ensure conformance with specifications and requirements. Subsequent testing to show compliance shall be at the Contractor's expense.
- D. Certify that all off-site import materials meet the requirements of this Specification prior to being delivered to the site. Particle size analysis of soils and aggregates shall be determined in accordance with ASTM D422.
- E. Unified Soil Classification System (USCS): References in these Specifications to soil classification types and standards set forth in ASTM D2487 have the meanings and definitions indicated in the 1992 revision.
- F. Provide adequate survey control to avoid unauthorized over-excavation and to provide elevation datum for testing agency.
- G. Material excavated when frozen or when air temperature is less than 32 degrees F shall not be used as fill or backfill until the material has completely thawed.
- H. Material excavated during inclement weather shall not be used as fill or backfill until after the material drains and dries sufficiently for proper compaction.
- I. Notify the Owner and Engineer when any of the following occur:
 - 1. Embankment fill is about to be placed on prepared foundation, or embankment fill operations are about to be resumed after a period of inactivity.
 - 2. Subgrade fill is about to be placed in overexcavated areas or subgrade fill operations are about to be resumed after a period of inactivity.
 - 3. Structures are ready for backfilling or backfill operations are about to be resumed after a period of inactivity.
 - 4. Soft or loose surface is encountered where fill or backfill is to be placed.
 - 5. Materials appear to be deviating from specifications.
 - 6. Initial sampling of imported material is to be conducted or importing of material to the site is about to begin.

- J. Notify and assist testing agency two weeks before backfill operations to obtain samples for Proctor compaction tests.

PART 2 PRODUCTS

2.01 SUITABLE FILL AND BACKFILL MATERIALS

- A. Suitable Materials: Soils not classified as unsuitable as defined in paragraph entitled, "Unsuitable Material" herein, are defined as suitable materials and may be used in fills, for backfilling, and for embankment construction subject to the limitations specified herein.
- B. Suitable materials may be obtained directly from on-site excavations, may be processed on-site materials, or may be imported.

2.02 DRAINROCK

- A. A crushed, angular material meeting the requirements of Colorado Department of Transportation, Class B filter material as follows:

<u>Sieve Size</u>	<u>Percentage Passing</u>
1-1/2-inch	100
No. 4	20 – 60
No. 16	10 – 30
No. 50	0 – 10
No. 200	0 – 3

2.03 RIPRAP

- A. Hard, durable, angular rock free from cracks, overburden, shale, and organic matter.
- B. Broken concrete or asphalt pavement is unacceptable.
- C. Neither breadth nor thickness of a single stone should be less than one-third its length. Rounded stone is unacceptable.
- D. Rock minimum specific gravity shall be 2.5 or greater and determined according to the bulk-saturated, surface-dry basis, AASHTO Test T85.
- E. Rock minimum density shall be 165 pounds per cubic foot.
- F. Rock shall have a percentage loss of not more than 40 percent after 500 revolutions by the Los Angeles abrasion test machine, ASTM C535.
- G. Rock shall have a percentage loss of not more than 10 percent after 12 cycles of freezing and thawing when tested in accordance with AASHTO Test T103, Procedure A, for ledge rock.
- H. Riprap shall meet the following gradation:

<u>Riprap Designation</u>	<u>Percent Smaller than Given Size by Weight</u>	<u>Intermediate Rock Dimensions (inches)</u>	<u>d₅₀ (inches)</u>
Type M	70-100	21	12"
	50-70	18	
	35-50	12	
	2-10	4	

- I. Grouted boulders shall be Classification B18, nominal size 18 inches, size range 17 to 20 inches with a ratio of largest to smallest dimension of individual boulders less than 2.5.
- J. Granular bedding for riprap shall conform to CDOT Section 703 requirements for aggregates and shall have the following gradations:

US Standard Sieve Size	Percent Passing by Weight	
	Type I	Type II
3-in		90-100
1.5 in		
3/4 in		20-90
3/8 in	100	
#4	95-100	0-20
#16	45-80	
#50	10-30	
#100	2-10	
#200	0-2	0-3

2.04 ROCKFILL

- A. A mixture of loose, hard, durable, angular rock free from cracks, overburden, shale, and organic matter meeting the following gradation:

<u>Sieve Size</u>	<u>Percentage Passing</u>
12-inch	70 – 100
9-inch	50 – 100
6-inch	35 – 50
2-inch	2 – 10

2.05 AGGREGATE BASE COURSE

- A. Imported, hard, durable, natural crushed stone or crushed gravel with sand and sufficient finer material for proper compaction, well-graded, and free from deleterious materials.
- B. Gradation as determined in accordance with ASTM C 117 and C 136:

<u>Sieve Size</u>	<u>Percent Passing</u>
3/4-inch	100
No. 4	30 – 65
No. 8	25 – 55
No. 200	3 – 12

- C. Liquid Limit not exceeding 30 and Plasticity Index not exceeding 6 as determined in accordance with ASTM D 4318.
- D. Percentage of wear by LA abrasion test less than 50 percent as determined in accordance with ASTM C 131.
- E. Material meeting the requirements of Class 6 Aggregate Base Course Material as specified in CDOT Section 703.03 may meet the requirements specified herein except that crushed slag, crushed reclaimed concrete, and asphalt, will not be allowed.

2.06 BEDDING AND PIPE ZONE MATERIAL

- A. Clean, well-graded, free-draining sand or squeegee sand with no clay fines and meeting the following gradation:

Sand

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/8-inch	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 – 85
No. 30	25 – 60
No. 50	10 – 30
No. 100	2 – 10
No. 200	0 – 5

Squeegee Sand

<u>Sieve Size</u>	<u>Percentage Passing</u>
3/8-inch	100
No. 200	0 – 3

2.07 TRENCH ZONE MATERIAL

- A. Material not otherwise classified as unsuitable.

2.08 STRUCTURAL FILL OR BACKFILL

- A. Well graded crushed rock or natural gravel meeting the following gradation requirements:

<u>Sieve Size</u>	<u>Percentage Passing</u>
2-inch	100
No. 4	30 – 100
No. 50	10 – 60
No. 200	5 – 10

2.09 RANDOM FILL

- A. On site fill material that has been previously placed over natural soil layers. Random fill shall not be used as structural fill, backfill, trench zone material or placed under paved surfaces. Random fill may be placed in landscaped areas with the approval of the Geotechnical Engineer.
- B. It is expected that Random Fill material in varied depths will be encountered in all required excavations and shall be removed.

2.10 SOIL FILTER MATERIAL

- A. Soil filter media shall consist of a silt sand soil mixture combined with a mature, moderately fine shredded bark or wood fiber mulch. The resulting mixture shall have 8% to 12% passing the No. 200 sieve and a clay content less than 2%. The soil mixture shall be composed of 50% sand meeting the requirements in the table below, 20% sandy loam meeting the requirements in the table below, and 30% mature composted woody fibers and fine shredded bark.

Sand Requirements	
Sieve #	% Passing by Weight
No. 10	85-100
No. 20	70-100
No. 60	15-40
No. 200	8-15
200 (clay size)	< 2.0

Sandy Loam Requirements	
Sieve #	% Passing by Weight
No. 4	75-95
No. 10	60-90
No. 40	35-85
No. 200	20-70
200 (clay size)	< 2.0

2.11 TOPSOIL

- A. Defined as the top 12± inches of the native soil profile in open or unimproved areas or as determined in the field by the Engineer.

2.12 CONTROLLED STRENGTH MATERIAL

- A. Seven (7)-day Compressive Strength: Not less than 100 psi or not more than 200 psi. Determine in accordance with ASTM D4832.
- B. Soil: Meeting the following requirements when tested in accordance with the designations as shown in the Eighth Edition - Revised Reprint of the Bureau of Reclamation (USBR) Concrete Manual and the Third Edition of the Bureau of Reclamation Earth Manual, Part 2.
- C. Soil producing a color darker than the standard color in the calorimetric test for organic impurities shall be rejected until further tests are performed to determine the nature of the material and its effect on the time of set and strength of cement (designation 14, Concrete Manual).
- D. The amount of soil passing the No. 200 sieve shall not exceed 30 percent, by weight, and the amount of soil passing the No. 100 sieve shall not exceed 50 percent, by weight (USBR 5530, Earth Manual). The soil shall be nonplastic or of low plasticity.
- E. The soil shall be selected or processed so that the gradation of the soil is such that all particles will remain in suspension, or no segregation will occur, when the controlled strength material is placed. The maximum particle size in the soil shall not exceed 1/8 of the open distance between the pipe and the trench wall or 1-1/2 inches, whichever is less.
- F. The maximum size of any clay balls in the soil shall be one-half inch. The maximum percentage of clay balls, by wet weight of the soil, shall not exceed 10 percent.
- G. The Water-Cement Ratio: Not to exceed 3.5:1. The water content shall not exceed that required to provide a mix that will flow and can be pumped.
- H. Batching Equipment: Provide to obtain the proper weights of soil, cement, and water. All measuring devices shall be sensitive to a 2% variation above or below the actual weights required.
- I. Mixers: Operate such that the slurry is discharged uniformly and is consistent throughout each batch.
- J. Consistency: Such that the controlled strength material flows easily into all openings between the pipe and the lower portion of the trench. When trenches are on a steep slope, a stiffer mix may be required. When a stiffer mix is used, vibrate to ensure the controlled strength material completely fills all spaces.

2.13 TRENCH PLUGS

- A. Construct from compacted clay soils with USCS classification of CL or CH and with at least 60 percent fines (passing the No. 200 sieve) and a Plasticity Index of 15 or greater. Alternatively, trench plugs may be constructed with lean concrete, controlled strength material, or on-Site silty sand soils processed with 20 lbs. bentonite clay per cubic yard.

2.14 UNSUITABLE MATERIAL

- A. Except where specifically noted otherwise, the following are unsuitable materials for fill, backfill and embankment materials.
 - 1. Soils which, when classified under ASTM D2487, fall in the classifications of Pt, OH, CH, MH, ML or OL or obvious clayey materials or expansive soils as determined by the Engineer.
 - 2. Any soil that cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use shall be classed as unsuitable material.
 - 3. Materials that are wet, soft, or frozen.
 - 4. Materials containing asphalt, concrete chunks, cinders, ashes, refuse, vegetable or organic material, boulders, rocks or other undesirable deleterious material.

2.15 GEOTEXTILES

- A. Woven: Composed of polypropylene yarn interlaced to form planar structure with uniform weave pattern. Inert to biological degradation. Manufacturers: Mirafi 500X or approved equivalent
- B. Nonwoven: Composed of continuous or discontinuous (staple) fibers held together through needle-punching, spun-bonding, thermal-bonding, or resin-bonding. Pervious sheet of polyester, polypropylene, or polyethylene fabricated into stable network of fibers that retain their relative position with respect to each other. Edges finished to prevent outer material from pulling away from geotextile. Manufacturers: Mirafi 140N or approved equivalent.

2.16 GEOMEMBRANE

- A. 30 mil (minimum) PVC liner meeting the following requirements:

Thickness, % Tolerance	+/-5
Tensile Strength, KN/m (lb/in)	12.25 (70)
Modulus at 100% Elongation, KN/m (lb/in)	5.25 (30)
Ultimate Elongation, %	350
Tear Resistance, N (lbs)	38 (8.5)
Low Temperature Impact, deg C (deg F)	-29 (-20)
Volatile loss, % Maximum	0.7
Pinholes, no. per 8 m ² (10 yd ²)	1 (max)
Bonded Seam Strength, % of Tensile	80

2.17 WATER

- A. Water for moisture conditioning shall be free from oil, acids, alkalis, organic materials, hazardous or toxic contaminants, or other contaminants deleterious to proper compaction. Water shall be provided at a source designated by the Owner. Contractor shall be responsible for the transportation of the water from the source to the point of application by methods acceptable to the Engineer.

PART 3 EXECUTION

3.01 EXCAVATION GENERAL

- A. Excavation is unclassified, and includes all materials encountered, regardless of type, condition, nature or extent.
- B. Any over-excavation carried below the grade ordered, specified, or shown, without written authorization from the Engineer shall be backfilled to the required grade with the specified material and compacted and graded as specified at no additional cost to the Owner.
- C. All excavation shall be performed in the dry but may require wetting to prevent dust from leaving the site.
- D. Selectively excavate, segregate, handle, haul, process and stockpile excavated materials as necessary to yield the maximum quantities of suitable materials for use as fill and backfill. Wetting stockpiles may be necessary to prevent blowing dust.
- E. Install and maintain sheeting, shoring, bracing and sloping as necessary to support the sides of excavations to protect against movement that may damage adjacent structures or foundations, damage or delay the work, or endanger life and health. Install and maintain sheeting, shoring, bracing and sloping as required by OSHA and other applicable governmental regulations or agencies.

3.02 STRUCTURE, ROADWAY AND EMBANKMENT EXCAVATION

- A. Excavate to the lines, grades and dimensions indicated and as necessary. Unless otherwise indicated, excavate to within a tolerance of plus or minus 0.1 foot. The bottom of the excavation shall not extend more than 3 inches below the lines and grades shown on the Drawings at any point.
- B. Unless otherwise specified, excavate a sufficient distance from walls and footings to allow access for the performance and inspection of placement and removal of forms, installation of reinforcement, embedments, bulkheads and blockouts, and placement of concrete.
- C. Excavation under roadways and paved areas shall extend to the top of natural soil layers. On site fill material is to be placed to the elevations indicated on the Drawings.

3.03 TRENCH EXCAVATION

- A. Unless otherwise shown or specified, excavate for pipelines and utilities using open-cut trenches.
- B. Trench Width
 - 1. Within the pipe zone
 - a. Provide a minimum of 12 inches on either side for pipe zone material or controlled strength material.
 - b. For multiple pipes, conduits, cables or duct banks in a single trench, 18 inches greater than the aggregate width of pipes, conduits, cables or duct banks plus space between.
 - c. Pipe of greater strength or superior bedding, when approved by the Engineer in writing, may be used in lieu of maintaining the specified trench widths within the pipe zone.

2. Increase trench widths by thickness of sheeting
 3. Above pipe zone: maximum trench width unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property or completed work.
- C. Trench Bottom: Excavate uniformly to 6 inches below the bottom of the pipe.
 - D. Open Trench: The maximum amount permitted in any one location shall be 150 feet, or the length necessary to accommodate the amount of pipe installed in a single day, whichever is greater. All trenches at road intersections shall be fully backfilled at the end of each day, including temporary asphalt surfacing. At the end of the day, the length of trench left open shall not exceed 150 feet. Barricades, fencing, and warning lights meeting OSHA and the Manual on Uniform Traffic Control Devices requirements shall be provided and maintained.
 - E. Over-Excavation and Trench Stabilization: When ordered by the Engineer, over-excavate to the depth ordered, cover the excavated surface with woven geotextile fabric such as Mirafi 500X, and backfill with Rockfill or Drainrock to 6 inches below the pipe. Additional payment will be made under the separate unit price bid item only for authorized over-excavation ordered by the Engineer.
 - F. Where pipelines are to be installed in embankment or structure fills, construct the fill to a level at least one foot above the top of the pipe before the trench is excavated.
 - G. When a movable trench shield is used it shall be moved by lifting free of the trench bottom or backfill then moving horizontally. Do not drag shield along trench in such a way as to cause damage or displacement of trench sidewalls, pipe, pipe bedding, or backfill.

3.04 EXCAVATION IN UNIMPROVED AREAS

- A. In unimproved areas, topsoil shall be stripped from the area of disturbance and stockpiled. Topsoil stockpiles shall be suitably protected from erosion by wind and water and shall be clearly identified.

3.05 PERMANENT EXCAVATION SLOPES

- A. Shape, trim and finish cut slopes to conform with the lines, grades, and cross sections indicated, with proper allowance for topsoil, or slope protection where shown. Slopes are not to exceed 3:1.
- B. Remove stones and rocks that exceed 6-inches in diameter and that are loose and could roll down-slope. Remove exposed roots from cut slopes.

3.06 REUSE OF CLEAN EXCAVATED MATERIAL

- A. Clean excess excavated material and rock that meet the specified requirements may be utilized as fill material.
- B. Contractor shall comply with all applicable federal, state, and county regulations, and city ordinances.
- C. Segregate and stockpile suitable excavated materials until material is needed for fill or backfill.
- D. Locate stockpiles as directed by the Engineer, stabilize slopes and provide erosion protection in accordance with the Grading, Erosion and Sedimentation Control Plan.

- E. Post signs indicating proposed use of stockpiled materials. Post signs that are clearly worded and readable from all directions of approach to each stockpile by equipment operators from their normal seated position.
- F. Do not stockpile excavated materials adjacent to trenches or other excavations unless excavation side slopes and support systems are designed, constructed and maintained for stockpile loads.
- G. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if the weight of stockpiled material could induce settlement or displacement.

3.07 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL

- A. Dispose of excavated materials which are unsuitable or exceed the quantities needed for fill or backfill in locations as directed by the Engineer.
- B. Moisture content alone shall not be an adequate reason for wasting otherwise suitable material. Moisture or dry such excavated materials to the specified moisture range and use for fill or backfill.

3.08 DISPOSAL OF A.C. PAVEMENT MATERIAL

- A. Asphalt pavement material may be disposed of at a certified asphalt recycling center. Pavement material not disposed of at a certified asphalt recycling center shall be disposed of in accordance with all federal, state, county and city ordinances.

3.09 BACKFILL GENERAL

- A. Do not drop directly upon any structure or pipe. Do not place around or upon any concrete structure until the concrete has attained sufficient strength to withstand the loads imposed. Sufficient strength shall mean full design strength unless directed otherwise by the Engineer. Backfill water retaining structures only after hydrostatic testing is complete and with the structure full of water.
- B. Except for Rockfill or Drainrock materials being placed in over-excavated areas in trenches, place backfill only after all water is removed from the excavation and bottom and sidewalls have dried to a moisture content suitable for compaction.
- C. Immediately prior to placing backfill material remove any loose or caving soil from the bottom and sidewalls of the excavation or trench.
- D. Keep placement surfaces free from standing water, debris, and foreign materials during placement and compaction of fill and backfill.
- E. Do not place fill or backfill if material is frozen or if the placement surface is frozen.
- F. Place and spread backfill materials in even layers, mixing as necessary to produce uniformity of moisture and material within the layer. The thickness of each layer shall be thin enough to allow the available equipment to achieve the specified compaction uniformly throughout but shall not exceed 8 inches.
- G. Adjust the moisture content of backfill material by wetting or drying and mixing as necessary until the moisture content is within the specified range.
- H. Compact each lift to the specified density at the specified moisture content prior to placing succeeding lifts.

- I. Slope lifts only as necessary to conform to final grades or to keep surfaces drained of water.
- J. Grade to establish the elevations, slopes and drainage as indicated on the drawings within a tolerance of 0.1 foot.
- K. Correct any settlement areas and repair any subsequent damage to structures, slabs, piping and other facilities caused by settlement of fill or backfill.

3.10 QUALITY CONTROL

- A. Quality control tests will be performed in accordance with Paragraph 1.5 prior to and during fill and backfill placement. Testing frequencies are to be coordinated with the Engineer. Additional testing will be performed whenever the initially established frequencies are unrepresentative due to variability in materials or construction operations, and to retest previously failed areas after corrective actions have been taken. Soil testing results indicated as passing shall be considered to be valid for a period of 72 hours unless soil conditions are believed to have been changed during that time due to a weather event. If work is not in progress after 72 hours or there has been a weather event retesting will be required.
- B. Prior to placement of fill and backfill a minimum of one laboratory compaction density test in accordance with ASTM D698, ASTM D 1557, or ASTM D 4254, as applicable, shall be performed for each different soil and bedrock material used. During fill and backfill placement, additional laboratory compaction tests will be done whenever material variation occurs such that the existing relationships are not representative of the material being placed.
- C. In place density and moisture content testing will be conducted at least once per day for each type of material being placed that day but not less than the following minimum frequencies:
 - 1. Pipe Zone Backfill: Once per 200 lineal feet of trench length at various depths from spring line to 1 foot above the top of pipe.
 - 2. Trench Zone Backfill: One test for each 1 foot of backfill for each 200 lineal feet of trench at various depths from 2 feet above the top of pipe to 1 foot below the ground surface.
 - 3. Random fill: Once per 500 cu yd
 - 4. Subgrade fill/Backfill: Once per 200 cu yd
- D. Verbal pass/fail reports shall be given to the Contractor immediately after completion of each field test, and written copies will be sent to the Engineer, Owner and Contractor and shall be available on-site at all times.

3.11 MOISTURE CONDITIONING AND PROCESSING EQUIPMENT

- A. Provide water trucks and/or tankers and other supplemental equipment necessary to uniformly apply water for moisture conditioning for proper compaction and wetting of completed courses prior to placement of overlying courses. Watering equipment shall have pressurized nozzles or other suitable means to assure uniform application of water at a controlled rate.
- B. Provide blades, discs, rotomill and other supplemental equipment as necessary to process borrow materials and pulverize bedrock into acceptable size particles, to blend fill and backfill materials, blend water with dry material, aerate and dry out wet material and for scarification of completed courses.
- C. Discs shall be of the type, size and power to blend to the full depth of loose lifts and to scarify a completed course to a depth of 2-inches for bonding overlying lifts. Discs shall be adjustable to provide light scarification where needed.

3.12 COMPACTION EQUIPMENT

- A. Provide dedicated compaction equipment of suitable type and size, specifically designed to achieve the requirements of the specifications with the types of soil materials used for the various purposes as specified.
- B. Provide hand-operated equipment in confined areas not accessible to larger equipment or where large equipment could damage structures or piping.

3.13 MOISTURE CONDITIONING AND PROCESSING

- A. Moisture condition and process material prior to and during borrow excavation so that material is within the specified moisture content and particle size limits at the time it is delivered to the fill area.
- B. Provide supplemental sprinkling on the fill to keep material within specified moisture content limits throughout the placement and compaction process, and to preserve moisture in completed courses until placement of overlying courses.
- C. Blend material by discing, blading, or harrowing to maintain uniform moisture content throughout the lift.
- D. Do not attempt to compact material that contains excessive moisture. Material that becomes too wet shall be removed or reworked. Aerate material by blading, discing, harrowing, or other methods to hasten the drying process.
- E. Provide suitable types and numbers of watering and blending equipment to keep pace with fill and backfill placement activities. Provide additional equipment or restrict material placement rates if watering and blending equipment cannot keep pace with fill and backfill placement.
- F. Maintain moisture conditions of the fill surface during nights, weekends, holidays, and other periods of temporary work stoppage.

3.14 COMPACTION

- A. Each layer of material shall be mechanically compacted to the specified percentage of maximum or relative density. Equipment that is consistently capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content. If tests indicate that the material, moisture content, or compaction are not as specified, or if the compaction equipment being used is not as specified or capable of producing specified results, suspend material placement and take corrective action as necessary.
- B. Operate compaction equipment in strict accordance with manufacturer's instructions and recommendations. Maintain the equipment so that it will deliver the rated compactive effort.
 - 1. Operate tamping foot rollers at a speed less than 5 miles per hour, and vibratory drum rollers at a speed less than 3 miles per hour.
 - 2. Operate sheepsfoot and tamping foot rollers to maintain the spaces between the individual feet clear of adherent materials that impair the effectiveness of the roller.
- C. In cold weather do not place new material on frozen soil and prevent new material from freezing.

3.15 COMPACTION REQUIREMENTS

A. Aggregate Base Course

Compaction: 98% Standard Proctor Compaction (ASTM D698)
Compaction Moisture: 2% below to 2% above optimum
Max. Lift Thickness: 6 inches

B. Pipe Bedding and Pipe Zone

Compaction: 95% Standard Proctor (ASTM D 698)
Compaction Moisture: N/A
Max. Lift Thickness: 8 inches

C. Trench Zone

Compaction: Under roads, sidewalks, roadway shoulders and irrigation ditches: 98%
Standard Proctor (ASTM D 698)
All other areas: 95% Standard Proctor (ASTM D 698)
Compaction Moisture: 2% below to 2% above optimum
Max. Lift Thickness: 8 inches

D. Subgrade Fill/Backfill

Compaction: 98% Standard Proctor (ASTM D 698)
Compaction Moisture: 2% below to 2% above optimum
Max. Lift Thickness: 8 inches

E. Random Fill

Compaction: 92% Standard Proctor (ASTM D698)
Compaction Moisture: 2% below to 2% above optimum
Max. Lift Thickness: 8 inches

F. Topsoil

Compaction: 85% Standard Proctor (ASTM D 698)
Compaction Moisture: 2% below to 2% above optimum

3.16 FOUNDATION PREPARATION

A. All fill material shall be removed beneath structures and paved areas. Natural soils exposed in the excavation shall be inspected and approved of by the Geotechnical Engineer. Additional material that is required to be placed over the natural soil shall be installed to achieve elevations shown on the Drawings.

B. Shape the excavation to provide a uniform and regular profile without abrupt changes in slope, sharp projections, overhangs, steps or benches.

C. Maintain the foundation in the soundest possible condition and free from standing water or deleterious materials.

D. Do not allow equipment on prepared foundation surface.

E. Complete construction of structure as soon as practical after foundation preparation is complete.

- F. Repair any damage to foundation from Contractor's operations, weather, or deterioration due to extended exposure before construction.

3.17 STRUCTURE, ROADWAY AND EMBANKMENT FILL AND BACKFILL

- A. Structure excavations shall be filled to final grade with compacted subgrade fill.
- B. Backfill within 5 feet of structures shall be subgrade fill compacted to a minimum of 98 percent Standard Proctor compaction (ASTM D 698) using hand-operated or walk behind compaction equipment.
- C. Backfill more than 5 feet from structures shall be subgrade fill compacted to a minimum of 95 percent Standard Proctor compaction (ASTM D 698) except under roadways and parking areas.
- D. Under paved areas and roads the exposed subgrade surface shall be scarified to a depth of 8 inches, moisture content adjusted to 2 % below to 2% above optimum, and compacted to a minimum of 98 percent of Standard Proctor density (ASTM D 698). Compacted subgrade fill is to be placed on prepared subgrade surface as needed to bring the finish grade up to elevations indicated on the Drawings. The finished subgrade shall have a uniform self draining surface sloped to match the finished pavement. Regrade as required to eliminate low areas that could accumulate standing water.
- E. Place and compact aggregate base course on nonwoven geotextile fabric installed over prepared subgrade fill for paved areas and roads as soon as practical after subgrade preparation is complete. See Drawings for geotextile fabric requirements.

3.18 RIPRAP

- A. Place riprap at the locations and to the dimensions, depths and grades as indicated on the drawings.
- B. Place riprap on a bed of granular bedding material consisting of 4-in minimum of Type I material overlain by 4-in minimum of Type II material. Alternatively a single 12-in layer of Type II material may be used except at drop structures where the two layer system shall be used.
- C. Place riprap commencing at the bottom of slopes working up the slopes. Place riprap in a stepped fashion with the bottom of the uphill riprap below the top of the downhill riprap by half of the height of the riprap minimum.
- D. Place riprap to its full course thickness in one operation and avoid displacing the underlying granular bedding material.
- E. Individual riprap rocks shall be carefully set in place using equipment or by hand. Dumping is prohibited.
- F. Place and distribute riprap so that rocks of different sizes are well mixed with no large accumulations of either large or small stones. Stones with dimensions equal to d50 or larger shall be placed at the top surface with faces and shapes matched to minimize voids and form as smooth a surface as practical. Hand placement will be required to achieve proper distribution.

3.19 GROUTED BOULDERS

- A. Place grouted boulders at the locations and to the dimensions, depths and grades as indicated on the drawings.

- B. Grade subbase to the lines and grades as required to produce the finished lines and grades as indicated on the drawings. Compact subbase as needed to provide a smooth uniform surface suitable for placement of grouted boulders. Place grouted boulders directly on prepared subbase without granular bedding.
- C. Place boulders as tightly as possible with required boulder height vertical and voids for grouting minimized.
- D. Prior to grouting, clean dirt and other material from rock that could prevent grout from bonding to rock.
- E. Grout shall fill all voids around the lower 2/3 of boulders. Top 1/3 of boulders shall remain clean and free of grout.
- F. Inject grout using a low-pressure grout pump using a suitably sized nozzle. Build up grout from the bottom of the boulder layer and use a pencil vibrator to ensure full depth penetration of grout and prevent voids.
- G. Immediately after grout placement remove grout spatters from exposed rock by scrubbing with wet brooms and brushes.
- H. Apply curing compound as specified in Section 03 30 00 to exposed grout surfaces.

3.20 PIPE TRENCH BACKFILL

- A. Pipe Bedding: Pipe bedding as shown on the Drawings shall be pipe zone material placed and compacted as specified herein. After placing the bedding, perform a final trim for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for welding shall be made as necessary.
- B. Pipe Zone Backfill
 - 1. Pipe zone backfill, as shown on the Drawings shall be pipe zone material.
 - 2. Where required, install tracer wire and cathodic protection prior to the start of backfill.
 - 3. The pipe zone shall be backfilled and compacted with the specified pipe zone material. Exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.
 - 4. Place and spread evenly in layers. When compaction is achieved using mechanical equipment, do not exceed 8-inches uncompacted thickness.
 - 5. Restrain all pipe as necessary to prevent movement during backfill operations.
 - 6. Place material simultaneously in 8-inch horizontal lifts on both sides of pipe and, if applicable, between pipes installed in the same trench.
 - 7. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by "walking in" and slicing material under haunches with a shovel to ensure that voids are completely filled before placing each succeeding lift.
 - 8. After the full depth of the pipe zone material has been placed, compact the material by a minimum of three passes with a vibratory plate compactor only over the area between the pipes and between the sides of the pipe and the trench walls.
 - 9. Do not use power-driven impact compactors to compact pipe zone material.
 - 10. Where the material moisture content is below the optimum moisture content, add water until the proper moisture content is achieved.

11. Where the material moisture content is too high to permit the specified degree of compaction, dry the material until the proper moisture content is achieved.
12. After placement of pipe zone backfill and prior to placement of trench zone backfill, the center of the pipe(s) shall be marked with pipe marking tape.

C. Trench Zone Backfill

1. Trench zone backfill as shown on the Drawings shall be suitable material placed and compacted as specified herein.
2. After the pipe zone backfill has been placed as specified above, and after any excess water has completely drained or been removed from the trench, backfilling of the trench zone may proceed.
3. Trench zone backfill material under roads or paved surfaces shall be structurally placed subgrade fill.

D. Backfill beneath Paved Areas

1. Backfill below paved areas shall be brought up to the bottom of the layer of aggregate base course.
2. All areas to receive pavement or concrete shall be proof-rolled prior to placement of these materials. Proof-rolling shall be conducted on all subgrade, fill or base material. After the material has been compacted, tested and found to meet specifications, the entire area shall be proof-rolled with a heavily loaded vehicle to ensure uniformity of the materials. The vehicle must have a loaded GVW of 50,000 pounds with a loaded single axle weight of at least 18,000 pounds and a tire pressure of 90 psi. Material which is pumping or deforming as identified by the Engineer must be reworked, replaced or otherwise modified to form a smooth, stable, non-yielding base for subsequent paving courses.

E. Topsoil: In unimproved or open areas, topsoil shall be evenly redistributed over all disturbed areas. Care shall be taken to conform to the required final grades.

F. Trench Plugs: Trench plugs shall be placed every 500 feet along the length of the pipe in wet areas, and where shown on the Drawings or as directed by the Engineer. Trench plugs shall be a minimum thickness of 2 feet as measured along the longitudinal pipe axis and replace the pipe zone material.

3.21 CONTROLLED STRENGTH MATERIAL

A. Placement: The pipe shall be laid on sand or earth berms, free from rocks larger than 3 inches and located at pipe quarter points. Controlled strength material shall be placed from one side of the pipe and rodded or vibrated, if necessary, so that it flows under the pipe until it appears on the other side. Controlled strength material shall then be added to both sides of the pipe and rodded or vibrated until it completely fills the space between the pipe and the lower portion of the trench. Where required to prevent uplift, the controlled strength material shall be placed in two stages, allowing sufficient time for the initial set of the first stage before the remainder is placed. Controlled strength material shall be deposited as nearly as practicable in its final position and shall not disturb the pipe trench or cause foreign material to become mixed with the controlled strength material. Controlled strength material shall be brought to 6 inches above the top of the pipe. Backfill shall not be placed until the controlled strength material has reached the initial set. If it is anticipated that backfill will not be placed over the controlled strength material within 8 hours, a 6-inch minimum cover of moist backfill shall be placed over the controlled strength material. The moisture in the 6-inch minimum cover shall be maintained until additional backfill is placed. If the

ambient temperature is 50°F or less, an additional 12-inch minimum cover of loose backfill shall be placed over the 6-inch moist backfill cover prior to the end of the working day.

- B. Controlled strength material shall not be mixed or placed when the air temperature is below 40°F. Provided, that if the temperature is 35°F or above, controlled strength material may be placed if the temperature is rising. Temperature of the controlled strength material shall be 50°F or greater at time of placement. If the Engineer determines that weather conditions are unsuitable, controlled strength material shall not be placed.
- C. No controlled strength material shall be placed in pipe trenches when the trench bottom or walls are frozen or contain frozen materials. Backfill placed as cover over the controlled strength material shall not contain any frozen material.

END OF SECTION

SECTION 31 23 19

DEWATERING AND DRAINAGE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Design, furnish, install, operate, monitor, maintain and remove a temporary dewatering system as necessary to lower and control water levels below subgrades of excavations to permit construction in the dry.
- B. Provide, maintain and remove temporary surface water control measures adequate to drain and remove surface water entering excavations.
- C. Collect and properly dispose of all discharge water from the dewatering and drainage systems in accordance with Project permits and Section 01 41 00.

1.02 RELATED WORK

- A. Environmental protection procedures are included in Section 01 41 00 and Section 01 57 19.
- B. Sedimentation and erosion control in accordance with the Contract Documents, Town of Superior Standard Details and Specifications, and Urban Drainage and Flood Control District Drainage Criteria Manual Vol. 3.
- C. Design and execute methods of controlling surface water and groundwater.
- D. Be solely responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements, and Work that may result from Contractor's dewatering or surface water control operations.
- E. Design review and field monitoring by Owner or Engineer shall not relieve the Contractor of responsibility for the Work.

1.03 SUBMITTALS

- A. In accordance with Section 01 33 00, submit a proposed initial plan for dewatering and coordinate with methods of excavation and excavation support.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe for observations wells, if required, shall consist of minimum 1-inch I.D. Schedule 80 PVC pipe and machine slotted PVC wellpoints, maximum size slot 0.020-inches.

PART 3 EXECUTION

3.01 GENERAL

- A. Control surface water and groundwater such that excavation to final grade is made in-the-dry, the bearing soils are maintained undisturbed, and softening and/or instability or disturbance due to the presence or seepage of water does not occur. All construction and backfilling shall proceed in the dry and flotation of completed portions of work shall not be permitted.

3.02 SURFACE WATER CONTROL

- A. Construct surface water control measures, including dikes, ditches, sumps, and other methods to prevent, as necessary, flow of surface water into excavations.

3.03 EXCAVATION DEWATERING

- A. Provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations. Excavations shall be kept dry, so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- B. Pipe and concrete shall not be laid in water nor submerged within 24 hours after being placed. Water shall not flow over new concrete within four (4) days after placement.
- C. In no event, shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of pipe by promptly placing backfill.
- D. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed capacity of subgrade soils to proposed bottom of excavation. If the subgrade of the trench bottom or excavations becomes disturbed due to inadequate drainage, excavate below normal grade as directed by the Engineer and refill with screened gravel as specified in Section 31 05 00 Earthwork at the Contractor's expense.
- E. Evaluate the impact of the anticipated subsurface soil/ water conditions on proposed method of excavation and removal of water.
- F. Where groundwater level is above the proposed bottom of excavation level, it is expected that some type of pumped dewatering system will be required for pre-drainage of soils prior to final excavation and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline, or fill will not be floated or otherwise damaged. It is further expected that the type of system, spacing of dewatering units and other details of the Work will have to be varied depending on soil/water conditions at a particular location and the season in which the work is being performed in.
- G. Dewater and excavate in a manner which does not cause loss of ground or disturbance to the pipe bearing soil or soil which supports overlying or adjacent structures.
- H. If initial dewatering system does not properly dewater the trench or excavation as specified, install groundwater observation wells as directed by the Engineer. Do not place any pipe or structure until the readings obtained from the observation wells indicate that the groundwater has been lowered a minimum of 6 inches below the bottom of the final excavation within the trench limits.
- I. Dewatering units used in the Work shall be surrounded by suitable filter sands and no fines shall be removed by pumping. Pumping from the dewatering systems shall be continuous until pipe or

structure is adequately backfilled. Stand-by pumps and stand-by power shall be provided. Full-time monitoring and assignment of a full-time attendant may be required.

- J. Water entering the excavation from precipitation or surface runoff shall be collected in the shallow ditches around the perimeter of the excavation, drained to sump and pumped from the excavation to maintain a bottom free from standing water.
- K. Existing or new sanitary sewers shall not be used to dispose of drainage.

END OF SECTION

SECTION 31 25 00

EROSION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section covers work necessary for temporary stabilization of soil to prevent erosion during and after construction and land disturbing activities. This work includes furnishing of all labor, materials, tools, and equipment to perform the work and services necessary as herein specified and as indicated on the Drawings. This work includes installation, maintenance, and final removal of all temporary soil erosion and sediment control measures as appropriate.
- B. The minimum areas requiring soil erosion and sediment control measures are indicated on the Drawings. Owner reserves the right to modify the use, location, and quantities of soil erosion and sediment control measures based on activities of Contractor and as Engineer considers to be in the best interest of Owner.
- C. See additional requirements in the Drawings.

1.02 SUBMITTALS

- A. Informational Submittals
 - 1. All permits related to control of erosion and sediment.
 - 2. Manufacturer's certificate of compliance attesting that erosion and sediment control products meet requirements of these Specifications.

1.03 GENERAL

- A. Soil erosion stabilization and sedimentation control consist of the following elements:
 - 1. Maintenance of existing permanent or temporary storm drainage piping and channel systems, as necessary.
 - 2. Construction of new permanent and temporary storm drainage piping and channel systems, as necessary.
 - 3. Construction of temporary erosion control facilities such as silt fences, check dams, etc.
 - 4. Topsoil and Seeding: Placement and maintenance of temporary seeding where indicated on the Drawings and on all areas disturbed by construction outside of the designated Work Limits.
- B. Contractor shall be responsible for phasing Work in areas allocated for his exclusive use during this Project, including all proposed stockpile areas, to restrict sediment transport. This will include installation of all required temporary erosion control devices, ditches, or other facilities.
- C. The areas set aside for Contractor's use during the Project may be temporarily developed to provide satisfactory working, staging, and administrative areas for his exclusive use. Preparation of these areas shall be in accordance with other requirements contained within these Specifications and shall be done in a manner to prevent sediment transport away from the area.

- D. All stockpiles anticipated to be left idle for longer than 14 days are considered permanent stockpiles and shall be stabilized by temporary seeding, covering, or similar measures, and protected by construction of silt fences and 2-foot, minimum depth, ditches, completely surrounding stockpiles and located within 10 feet of the toes of the stockpile slopes.
- E. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond the immediate stockpile area by construction of temporary toe-of-slope ditches, berms, and silt fences, as necessary. Contractor shall keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance. Stockpiles remaining in place longer than 14 calendar days shall be considered permanent stockpiles for purposes of erosion and sediment control.
- F. Contractor shall maintain all erosion and sediment control measures in functional conditions for the duration of this Project. Formal inspections by Contractor shall be conducted every 2 weeks and as soon as possible after a stormwater runoff event to evaluate Contractor conformance to the requirements of these Specifications. Contractor shall include results of these required inspections, and a summary of all corrective actions, in Contractor's daily reports. Additional inspections may be conducted by Engineer at the discretion of Engineer.
- G. All silt traps shall be cleaned of collected sediment after every storm or as determined from the biweekly inspections. Cleaning shall be done in a manner that will not direct the sediment into natural or man-made storm drainage systems. Removed sediment shall be taken to an area selected by Engineer where it can be cleaned of sticks and debris, then allowed to dry. Final sediment and debris disposal shall be on-site as designated by Engineer.
- H. Replacement or repair of failed or overloaded silt fences, check dams, or other temporary erosion control devices shall be accomplished by Contractor as needed, but not later than 2 days after receiving written notice from Engineer.
- I. Unpaved earth drainage ditches shall be regraded as needed to maintain original grade and remove sediment buildup. If a ditch becomes difficult to maintain, Contractor shall install additional erosion control devices such as check dams, temporary paving, or silt fences upgradient of the ditch, or as directed by Engineer. Contractor is responsible for obtaining all necessary permits for ditch cleaning.
- J. Seeding of disturbed surfaces shall be completed as soon as practicable after grading is substantially completed in a given area (as defined by Engineer).
- K. Fugitive dust emissions resulting from grading activities and/or wind shall be controlled using the best available control technology, as defined by the Colorado Department of Public Health and Environment, at the time of grading. During grading, applying a combination of water, tackifier and silt fence to break up wind surface velocities may control dust. If wind speeds exceed the ability of BMPs to control fugitive dust, grading activities must cease.
- L. If Contractor has not complied with any of the above maintenance efforts to the satisfaction of Engineer within 2 working days after receiving written notification from Engineer, Owner shall have the prerogative of engaging others to perform any needed maintenance or cleanup, including removal of accumulated sediment at constructed erosion control facilities, and deduct from Contractor's monthly partial payment the costs for such efforts plus a \$500 administration fee.

1.04 DEFINITIONS

- A. Pure Live Seed (PLS): Pure live seed expressed as a percentage. It is the result of a calculation that takes into account the percentage purity of a given seed lot and the percentage viability of the seed in that lot. PLS tests are performed on single species lots.

$$\text{PLS \%} = \% \text{ Purity} \times \% \text{ Live Seed}$$

- B. Purity is the percentage of desirable seed in the lot sample. Any weed seed or chaff in the lot sample reduces the purity percentage. Any seed species other than the target seed species is considered weed seed. All seed mixes shall be totally free of noxious weed seeds.

- C. The live seed percentage combines three separate values:

% germination + % hardness + % dormancy.

Therefore: $\text{PLS \%} = \% \text{ purity} \times (\% \text{ germination} + \% \text{ hardness} + \% \text{ dormancy})$.

PART 2 PRODUCTS

2.01 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. Other Materials

1. Furnish in standard packaging.
2. Keep dry during storage

2.02 TEMPORARY SEED

- A. As specified in the Drawings.

2.03 FERTILIZER

- A. Fertilizer shall be commercial, chemical type, uniform in composition, free-flowing, conforming to state and federal laws, and suitable for application with equipment designed for that purpose.
- B. Fertilizer composition to be pre-determined and agreed upon by Owner and Engineer prior to start of fertilizer application. Do not use fertilizer unless approved by Owner.
- C. Fertilizer shall have a minimum percentage of plant food by weight for the following: Permanent fertilizer mix shall be 10 percent nitrogen, 10 percent phosphoric acid, and 10 percent potash.

2.04 MULCH

- A. Use only 100 percent certified weed free mulch. Use locally or regionally produced mulch when practicable.

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. Rantec; "Super Tack".
 - b. Or approved equivalent

2.06 EROSION CONTROL BLANKET AND LOGS

- A. Material
 - 1. Excelsior or straw; anchorages as recommended by manufacturer. No plastic net will be acceptable.
 - 2. Material shall be photo-degradable so that it will naturally degrade and deteriorate in its entirety in a few years.
 - 3. Pins and Staples: 0.162 inch in diameter minimum wire "U" shaped with legs 8 inches long and 1 inch crown, or wood stakes are to be used. "T" shaped pins are not permitted.
 - 4. Manufacturers and Products:
 - a. American Excelsior Company, AEC Premier Coconut™
 - b. Or approved equivalent
 - c. For areas of concentrated water flow as approved by the Engineer: North American Green C350™ TRM, or approved equivalent

2.07 SILT FENCE

- A. As specified in the Drawings.

2.08 STRAW BALES

- A. Machined baled clean salt hay or straw of wheat or barley, free from seed of noxious weeds.

2.09 CONCRETE WASHOUT STRUCTURE

- A. As specified in the Drawings.

2.10 VEHICLE TRACKING PADS

- A. As specified in the Drawings.
- B. Geotextile: Class A meeting the requirements of Colorado Department of Transportation, Standard Specifications for Road and Bridge Construction, Table 712-2.

2.11 CURB SOCKS

- A. As specified in the Drawings.

2.12 REINFORCED PLASTIC COVERING

- A. Co-extruded, copolymer laminate reinforced with nonwoven grid of high strength nylon cord submersed in a permanently flexible adhesive media allowing for equal tear resistance in all directions.
- B. Black in color and ultraviolet stabilized.
- C. Physical Requirement (Minimum Average Roll Values):
 - 1. Tear Strength: 130 pounds.
 - 2. Elongation: 620 percent.

PART 3 EXECUTION

3.01 GENERAL

- A. Minimize the area of disturbance to defined construction limits and limit the time bare soil is exposed.
- B. Contractor shall install erosion and sediment control measures as shown on the Drawings and additional measures as may be necessary. All erosion and sediment control measures shall be maintained throughout construction.
- C. Contractor shall provide and maintain Temporary Seeding at all times.
- D. In areas where work is complete and no additional construction traffic is expected, Contractor shall provide permanent seeding per the Permanent Seeding Schedule.

3.02 SILT FENCE

- A. Maintain silt fence as specified in the Drawings.

3.03 TEMPORARY SEEDING

- A. General:
 - 1. Temporary seeding shall be promptly placed and maintained over all disturbed areas.
 - 2. Contractor shall give at least 3 days notice to Engineer prior to seeding to allow Owner to inspect the prepared areas. Contractor shall rework any areas not approved for seeding to Owner satisfaction.
 - 3. Contractor shall keep Engineer advised of schedule of operations.
 - 4. Seed shall be clean, delivered in original unopened packages and bearing an analysis of the contents, guaranteed 95 percent pure with minimum germination rate of 85 percent.
- B. Seedbed Preparation:
 - 1. Scarify disturbed areas that have been subject to vehicular and/or equipment traffic to a minimum depth of 4 inches.
 - 2. If the surfaces of stockpiles are loose and generally uncompacted, they do not need to be scarified.

C. Seeding Schedule:

1. Temporary Seeding shall be performed in accordance with the following schedule:
 - a. Temporary seeding may be applied anytime, as long as the soil is not frozen or wet. Erosion blankets or crimped mulch are required for ground stabilization if conditions are unfavorable for temporary seeding.

D. Temporary Seeding:

1. Install seeding as specified in the Drawings. Temporary seeding shall be broadcast applied with mulch. Contractor may opt to drill seed in areas where Contractor determines that drill seeding will result in more successful growth of temporary seeding.
2. Mulch shall be crimped into the ground with a disker to protect site. On areas with slopes equal to or steeper than 3H:1V, in windy areas, and in areas with concentrated runoff flows, install and anchor erosion control blankets over the mulch. Select blanket type and installation method according to manufacturer's specifications.
3. Hydroseeding will be permitted as an alternative method of applying seed and associated soil conditioning agents described above. If Contractor prefers to apply temporary seeding by hydroseeding methods, Contractor shall submit an operational plan for approval.
4. Maintain temporary seeding until such time as areas are approved for permanent seeding. As a minimum, maintenance shall include fix-up and reseeded of bare areas or redisturbed areas.

3.04 MULCHING

- A. Application: As specified in the Drawings.

3.05 TACKIFIER

- A. Apply on areas mulched with straw.
- B. Spray on after mulch is in place.
- C. Apply in quantities sufficient to equal retention properties of a CSS-1 asphalt emulsion being applied at rate of 400 gallons per acre.

3.06 STRAW BALES

- A. Install as specified in the Drawings.

3.07 CONCRETE WASHOUT STRUCTURE

- A. Rinse out concrete mixers and hoppers of concrete pumps after delivery into concrete washout structure. Provide potable water for rinsing as necessary.
- B. Construct as indicated in the Drawings. Size to handle solids, wash water, and rainfall to prevent overflow.
- C. Site concrete washout structures at least 500 feet away from any waterway.

- D. Inspect concrete washout structures after use. Maintain and repair as necessary. Prevent runoff of liquids from structure. Clean out and dispose material once the structure is filled to 75 percent capacity to an appropriate disposal facility.

3.08 VEHICLE TRACKING PADS

- A. Install vehicle tracking pads at locations shown in the Drawings. Install and maintain in accordance with the Drawings.

3.09 CURB SOCKS

- A. Install curb socks for storm inlet protection.
- B. Install and maintain curb socks in accordance with the Drawings.

3.10 REINFORCED PLASTIC COVERING

- A. Place on areas where hydroseeding and erosion control blankets have not controlled erosion.
- B. Install in single thickness, strips parallel to direction of drainage.
- C. Maintain tightly in place by using sandbags on ropes with a maximum 10-foot grid spacing in all directions.
- D. Tape or weight down full length, overlap seams at least 12 inches.
- E. Remove at final acceptance unless notified otherwise by Engineer.

END OF SECTION

SECTION 33 05 61

CONCRETE MANHOLES AND STRUCTURES

PART 1 GENERAL

1.01 SCOPE

- A. Furnish all labor, materials, and equipment required to install concrete manholes, structures, frames and covers, manhole rungs, and appurtenances as shown on Drawings and as specified herein.

1.02 RELATED WORK

- A. Excavation and backfill is included in 31 05 00.
- B. Screened gravel bedding is included in 31 05 00.
- C. Cast-in-place concrete is included in Section 03 30 00.

1.03 SUBMITTALS

- A. Submit shop drawings, product data, materials of construction, and details of installation in accordance with Section 01 33 00 Include the following:
 - 1. Base sections, riser sections, eccentric and concentric conical top sections, flat slab tops, grade rings with notarized certificate indicating compliance with ASTM C478.
 - 2. Pipe connections to manhole.
 - 3. Manhole rungs or ladders, including method of installation and notarized certificate including compliance with pull-out resistance test specified in this Section.
 - 4. Manhole frame and cover with notarized certificate indicating compliance with ASTM A48, Class 30B.
 - 5. Method of repair for minor damage to precast concrete sections.
- B. Design Data
 - 1. Precast concrete sections
 - a. Sectional plan(s) and elevations showing dimensions, penetrations and reinforcing steel placement.
 - b. Structural calculations including assumptions.
 - c. Concrete design mix.
- C. Test Reports
 - 1. Precast concrete sections: Concrete compressive strength test cylinder reports from an approved testing laboratory certifying conformance with specifications. Compressive strength test reports shall be less than 12 months old.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Specification for Gray Iron Castings.
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM C32 - Specification for Sewer and Manhole Brick (Made from Clay or Shale).
4. ASTM C33 - Specification for Concrete Aggregates.
5. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale).
6. ASTM C150 - Standard Specification for Portland Cement.
7. ASTM C207 - Specification for Hydrated Lime for Masonry Purposes.
8. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
9. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections.
10. ASTM D4101 - Specification for Propylene Plastic Injection and Extrusion Materials.

B. American Concrete Institute (ACI)

1. ACI 318 - Building Code Requirements for Reinforced Concrete
2. ACI 350R - Concrete Sanitary Engineering Structures

C. American Association of State Highway and Transportation Officials (AASHTO)

1. Standard Specifications for Highway Bridges

D. Occupational Safety and Health Administration (OSHA)

E. Where reference is made to one of the above standards, the revision in effect at the time of the bid opening shall apply.

1.05 QUALITY ASSURANCE

A. All material shall be new and unused.

B. Materials' quality, manufacturing process, and finished sections are subject to inspection and approval by Engineer and other Owner's representative. Inspection may be made at place of manufacture, at work site following delivery, or both.

C. Materials will be examined for compliance with ASTM specifications, these Specifications and approved manufacturer's drawings. Additional inspection criteria shall include: appearance, dimension(s), blisters, cracks and soundness.

D. Materials shall be rejected for failure to meet any Specification requirement. Rejection may occur at place of manufacture, at work site, or following installation. Mark for identification rejected materials and remove from work site immediately. Rejected materials shall be replaced at no cost to Owner.

- E. Repair minor damage to precast concrete sections by approved method, if repair is authorized by Engineer.

PART 2 PRODUCTS

2.01 GENERAL

- A. Reference to a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials/equipment shall be the end products of one manufacturer in order to provide standardization of appearance, operation, maintenance, spare parts, and manufacturer's service.
- C. Provide lifting lugs or holes in each precast section for proper handling.

2.02 PRECAST CONCRETE MANHOLE SECTIONS

- A. Precast concrete riser sections, transition top sections, flat slab tops, and grade rings shall conform to ASTM C478 and meet the following requirements:
 - 1. Manholes which are 5 feet or less in depth as measured from the invert to the top of the rim shall have a flat reinforced concrete top. Manholes greater than 5 feet deep as measured from the invert to the top of rim shall use an eccentric conical top section. Base, riser, and transition top sections shall have tongue and groove joints.
 - 2. Sections shall be cured and by an approved method.
 - 3. Precast concrete sections shall be shipped after concrete has attained 3,000 psi compressive strength.
 - 4. Design precast concrete base, riser, transition top, flat slab top, and grade ring for a minimum H-20 loading plus earth load. Calculate earth load with a unit weight of 130 pcf. Lateral soil pressure = 115 pcf/ft.
 - 5. Mark date of manufacture, name and trademark of manufacturer on the inside of each precast section.

2.03 PRECAST CONCRETE STRUCTURES

- A. Precast reinforced concrete structures include Tee-section manholes. Refer to Drawings for inside dimensions, headroom requirements, and minimum thickness of concrete.
- B. Manufacturer shall notify Engineer at least five working days prior to placing concrete during manufacturing process. Engineer may inspect reinforcing steel placement prior to placing concrete.
- C. Structural design calculations and Drawings shall be prepared and stamped by a Professional Engineer registered in the State of Colorado.
- D. Design Criteria
 - 1. Precast concrete
 - a. Minimum compressive strength shall be 5,000 psi.
 - b. Maximum water content shall be 5.5 gallons per 94 pound sack of cement.

- c. Minimum cement content shall be six 94 pound sacks of cement per cubic yard of concrete.
2. Manufactured products
- a. Conform to ACI 318 and ACI 350R.
 - b. Analyze walls and slabs using accepted engineering principals.
 - c. When "fy" exceeds 40,000 psi, "z" (ACI 318) shall not exceed 95,000 lb/in. "fs" shall not exceed 50 percent of "fy."
 - d. Design products to support their own weight, weight of soil at 130 pcf, and a live load equal to AASHTO HS-20 applied to top slab. Lateral soil pressure = 115 pcf.
 - e. Cast base slab and walls together to form monolithic base section.
 - f. Design structure walls for a water pressure assuming groundwater level at ground surface. Originate pressure diagram at finished ground surface. Include lateral pressure from vehicles in accordance with AASHTO.
 - g. Consider discontinuities in structure produced by openings and joints. Provide additional reinforcing around openings. Frame openings to carry full design loads to support walls.
 - h. Prevent flotation, with ground water level at finished ground surface, by dead weight of structure and soil load above structure. Do not consider skin friction, soil friction, or weight of equipment in structure. Minimum factor of safety = 1.25.
 - i. Locate horizontal wall joints 18-in. minimum from horizontal centerline of wall openings.
 - j. Design structure with a minimum number of joints. Maximum number of structure sections, including top slab, shall be four.
 - k. Provide corrosion resistant lifting hooks for top slab.
 - l. Locate access openings, wall sleeves, and pipe penetrations as shown on the Drawings.

2.04 MANHOLE FRAME AND COVER

- A. Heavy-duty manhole frame and covers shall be manufactured to meet H-20 traffic load conditions and be good quality, strong, tough, even grained cast iron, smooth, free from scale, lumps, blisters, sand holes, and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30B or better.
- B. The standard Town of Superior manhole shall be Neenah R-1780, or approved substitute with the word 'Sewer' on the cover. Cover shall have a type "F" Pick-hole in accordance with the Town of Superior Design Standards and Specifications.

2.05 JOINTING PRECAST MANHOLE SECTIONS AND STRUCTURES

- A. Seal tongue and groove joints of precast manhole and structure sections with preformed flexible joint sealant. Preformed flexible joint sealant shall be Rub'R-Nek as manufactured by K.T. Snyder Company, or approved equal in accordance with the Town of Superior Design Standards and Specifications.

- B. Completed joint shall withstand 15 psi internal water pressure without leakage or displacement of sealant.

2.06 MANHOLE RUNGS

- A. Manhole rungs shall be polypropylene reinforced plastic-coated steel in accordance with Town of Superior Design Standards and Specifications. Manufacturers: M.A. Industries, or approved equal.

2.07 PIPE CONNECTIONS TO MANHOLES AND STRUCTURES

- A. Connect pipe to manholes and structures using modular mechanical seal per Drawings and Section 33 14 13.

2.08 DAMPROOFING

- A. Damproofing shall be Hydrocide 700B by Sonneborn Building Products; Dehydratine 4 by A.C. Horn Inc; RIW by Toch Brothers, or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Manhole and Structure Installation

1. Manhole and structure shall be constructed to the dimensions shown on Drawings and as specified in these Specifications. Protect all work against flooding and flotation. Construct cast-in-place bases in accordance with the requirements of Division 3 and the details shown on the Drawings.
2. Place manhole base on a bed of 12 inches of screened gravel as shown on the Drawings. Set manhole base grade so that a maximum grade adjustment of 8 inches is required to bring the manhole frame and cover to final grade. Use precast concrete grade rings or brick and non-shrink mortar to adjust manhole frame and cover to final grade.
3. Set precast concrete barrel sections and structures plumb with a 1/4-inch maximum out of plumb tolerance allowed. Seal joints of precast barrel sections with preformed flexible joint sealant in sufficient quantity to fill 75 percent of joint cavity. Fill the outside and inside joint with non-shrink mortar and finished flush with adjoining surfaces. Caulk the inside of any leaking barrel section joint with lead wool or non-shrink grout to the satisfaction the Engineer.
4. Allow joints to set for 14 hours before backfilling unless a shorter period is specifically approved by the Engineer.
5. Plug holes in the concrete barrel sections required for handling with a non-shrink grout or non-shrinking grout in combination with concrete plugs. Finish flush on the inside.
6. Cut holes in precast sections to accommodate pipes prior to setting manhole sections in place to prevent jarring which may loosen the mortar joints.
7. Backfill carefully and evenly around manhole sections.

B. Manhole Pipe Connections

1. Construct manhole pipe connections, including pipe stubs, as specified above. Close or seal pipes for future connections with gasketed watertight plug.

C. Manhole Rung Installation

1. Steel Reinforced Polypropylene Plastic Manhole Rungs
 - a. Preform holes for manhole rungs during casting of the riser and cone sections, using tapered form pins specifically made for preforming manhole rungs.
 - b. Drive manhole rungs into preformed holes after concrete has developed a compressive strength of 3,000 psi.
 - c. Alternatively, cast manhole rungs into riser and cone sections when concrete is placed.
 - d. Drilling holes for manhole rungs may be used to accommodate field conditions when approved by the Engineer. Drill holes of diameter, spacing, and depth required by the manhole rung manufacturer.
2. Pull-out resistance test
 - a. All manhole rung installation methods shall withstand a pull-out resistance test of 1,500 pounds.

D. Setting Manhole Frame and Cover

1. Utilize precast concrete grade rings to assure frame and cover are set to the finished grade. Final grade adjustments are made using a minimum of four inches of concrete grade rings. Concrete grade rings shall make up the riser section providing the riser section does not exceed twelve inches vertically. Set manhole frame and cover to final grade prior to placement of permanent paving.
2. Manhole rings shall be securely attached to the manhole riser section with a grout bed and plastic joint sealing compound in pavement, or with a concrete collar in unpaved areas.

- E. Damproofing: Paint outer surfaces of precast and cast-in-place manholes and structures with two coats of bituminous damproofing at the rate of 30 to 60 sq ft per gallon, in accordance with manufacturer's instructions.

3.02 LEAKAGE TESTS

- A. Test each manhole for leakage.
- B. Assemble manhole in place; fill and point all leaking holes and exterior joints with an approved non-shrinking mortar.
- C. If there is no leakage into the manhole, the manhole will be considered water-tight. If the Engineer is not satisfied, other testing shall be performed such as exfiltration test.
- D. Leakage Tests for Structures
 1. The Engineer will visually inspect structure(s) for possible leaks before backfilling of structures is allowed. Seal all joints to the satisfaction of the Engineer.
 2. The Engineer may require an exfiltration test on any structure for which he/she determines to be visibly leaking.

3.03 CLEANING

- A. Thoroughly clean all new structures of all silt, debris and foreign matter of any kind, prior to final inspections.

END OF SECTION

SECTION 33 14 13

PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section specifies plant piping systems, fittings, pipe support systems, pressure and leak testing, installation requirements, and piping schedules.

1.02 REFERENCES

- A. This section contains references to the following industry and trade group standards. They are a part of this section as specified and modified. The latest version of the standard references shall apply. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

1. AASHTO HS20 - Loading, Tractor Truck with Semi Trailer
2. AASHTO HB-17 - Standard Specifications for Highway Bridges
3. AASHTO T99-01 - Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305-mm (12-in) Drop
4. ASME B16.25-1999 - Butt-Welding Ends
5. ASTM A674-00 - Standard Specification for Polyethylene Encasement for Ductile Iron Pipe for Water and Other Liquids
6. ASTM A153/A153M-03 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
7. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
8. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications
9. ASTM A283 - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
10. ASTM A513 - Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing
11. ASTM A525 - STANDARD SPECIFICATION FOR GENERAL REQUIREMENTS FOR STEEL SHEET, ZINC- COATED (GALVANIZED) BY THE HOT-DIP PROCESS
12. ASTM A536 - Standard Specification for Ductile Iron Castings
13. ASTM A780 - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
14. ASTM B1000-21 - Standard Practices for Casting Preparation and Test Procedure of Porcelain Enamel-lined Pipe, Fittings, and Valves for Use in the Municipal Wastewater, Sewage, and Water Treatment Industry
15. ASTM B695 - Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
16. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications

17. ASTM D5162 - Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates
18. ASTM D791 - Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals
19. ASME B31.1-2001 - Power Piping - ASME Code for Pressure Piping
20. ASME B31.3-2002 - Process Piping
21. ASME B31.9-1996 - Building Services Piping - ASME Code for Pressure Piping
22. ASME BPVC-2013 - Boiler and Pressure Vessel Code
23. AWWA C111/ANSI A21.11-00 - Standard for Rubber Gasket Joints for Cast Iron and Ductile Iron Pressure Pipe and Fittings
24. AWWA C104/ANSI A21.4-03 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water
25. AWWA C105/ANSI A21.5-99 - Polyethylene Encasement for Ductile Iron Pipe Systems
26. AWWA C600 – Installation of Ductile-Iron Mains and Their Appurtenances
27. AWWA C605 – AWWA Standard for Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
28. AWWA C924M – Standard Practice for Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method
29. ASTM C969/C969M - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
30. AWWA C207 - Steel Pipe Flanges for Waterworks Service
31. AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings
32. AWWA C214 - Machine-Applied Polyolefin Tape Coatings for Steel Water Pipe
33. AWWA C219 - Bolted Sleeve-Type Couplings for Plain-End Pipe
34. AWWA C606 - Grooved and Shouldered Joints
35. AWWA C653 - Disinfection of Water Treatment Plants
36. AWWA M11 - Steel Pipe - A Guide for Design and Installation
37. ASTM C 969/C 969M - Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
38. AWS D1.1 - Structural Welding Code—Steel - 24th Edition
39. AWS QC1 - Certification of Welding Inspections
40. MSS SP-58-2009 - Pipe Hangers and Supports – Material, Design, and Manufacturer
41. MSS SP-69-2002 - Pipe Hangers and Supports - Selection and Application
42. NFPA 24 - Standard for Installation of Private Fire Service Mains and Their Appurtenances
43. SSPC SP1 - Surface Preparation Specification No. 1 - Solvent Cleaning
44. SSPC SP2 - Surface Preparation Specification No. 2. - Hand Tool Cleaning

1.03 DEFINITIONS

A. Wetted and Submerged

1. For the purposes of defining piping installations and the required materials, joints and corrosion protection, these terms are defined as any location at an elevation below the elevation of the following, as applicable:
 - a. Inside hydraulic structures and channels.
 - b. The top face of hydraulic structure and channel walls and cover slabs.
 - c. Walkways over hydraulic structures and channels.

B. Pressure Terms

1. Maximum operating: The greatest continuous pressure at which the system operates.
2. Test: The pressure used to determine system acceptance.

1.04 SUBMITTALS

A. Provide following submittals consistent with Section 01 33 00.

1. Metal Framing Pipe Support Systems
 - a. Detailed installation drawings, catalog information, and complete component specifications.
2. Ductile Iron Wall Pipe
 - a. Manufacturer's data, including thrust collar type and the test report substantiating the pressure rating and safety factor for fabricated thrust collars.
3. Expansion Joints and Expansion Compensators
 - a. Manufacturer's data on materials, construction, and ratings.
4. Flexible Metal Hose
 - a. Manufacturer's data on materials, construction, end connections, ratings, overall lengths, and live lengths.
5. Couplings
 - a. Manufacturer's data on materials, construction and ratings for middle rings, followers, gaskets, nuts and bolts.
6. Fittings
 - a. Manufacturer's data on materials, construction and ratings for fittings.
7. Support System
 - a. Drawings of piping, locating supports, hangers, guides and anchors. Identify support, hanger, guide, and anchor type by catalog number and shop drawing detail number.
8. Shop Fabricated Piping Systems or Assemblies
 - a. Submit layout drawings that detail each pipe and fitting. Also include numbering or other labeling system that shall be used in the field to assemble prefabricated components.
9. Pipe Wall Thickness
 - a. Identify wall thickness and standard applied for each size of each different service including exposed, submerged, buried, and concrete-encased installations.

10. Hydraulic Thrust Restraint
 - a. Details including materials, sizes, and assembly ratings, and pipe attachment methods for each pipe material.
11. Dissimilar Pipes
 - a. Provide joint types and drawings for dissimilar pipes.
12. Welding
 - a. Inspection and Testing Laboratory Qualifications: Submit background information including experience, years in business, and three references for proposed independent testing laboratory.
 - b. Performance Qualifications: Prior to start of work, submit list of welders and welding operators, and types of welding for which each has been qualified, for both shop and field welding.
13. Ductile Iron Wall Pipe
 - a. Manufacturer's certified test report substantiating pressure rating and safety factor specified.
14. Pipe Base and Pipe Zone Materials
 - a. Identify material type, gradation, and source.
15. Steel Pipe and Fittings Certification
 - a. Steel pipe and fittings on this project shall be manufactured and fabricated in a plant certified under the Steel Plate Fabricators' Association Quality Assurance Program.
16. Manufacturer's Certification of Compliance
 - a. For manufactured items and materials to certify compliance with the Specifications.
17. Certificates of Inspection and Testing
 - a. For Specified inspection and testing, include test logs and reports.
18. Hydrostatic Testing
 - a. Detailed plan for filling and testing pipeline sections; submit at least 14 days in advance of testing.
 - b. Testing procedures to be used, locations for necessary equipment and materials, and date and duration of tests.
 - c. Results of all pipe testing.
19. Contract Closeout
 - a. Maintenance and operation information on piping support systems, corrosion protection, and insulation, as applicable.
 - b. List of manufacturer's recommended spare parts inventory for specified item.
 - c. Accessories and components having a shorter service life than their respective piping.

1.05 QUALITY ASSURANCE

A. Welder and Welding Operator Performance

1. Qualify welders and welding operators by approved testing laboratory before performing any welding under this section.
2. Perform welder qualification tests in accordance with AWS D1.1.
3. Qualification tests may be waived if the Engineer deems evidence of prior qualification suitable.
4. Qualify welders and operators in the performance of making welds in each different pipe material, including carbon steel pipe for each welding process to be used.
5. Qualify welders and welding operators for stainless steel as stated herein on the type of stainless steel being welded with the welding process used.
6. Retest any welders at any time when Engineer considers quality of the welder's work substandard. Labor costs for retest will be born by the Owner if welder successfully passes test. If welder fails test, all costs shall be born by the Contractor.

B. Welder Inspection and Testing Laboratory Qualifications

1. Owner may retain approved independent testing laboratory that will provide the services of an AWS certified welding inspector qualified in accordance with AWS QC1 with prior inspection experience of the welds specified herein.

1.06 DELIVERY, STORAGE AND HANDLING

A. Pipe

1. Protect, support, and handle in a manner to prevent damage to the products, especially linings and coatings.
2. When necessary, provide shelter to store pipe and apply water to prevent excessive drying.
3. During cold weather, store pipe on supports to prevent coating from freezing to the ground.
4. Do not store pipe on rock or other hard surface.
5. Use implements, tools, facilities, and equipment suitable for proper and safe protection and handling of piping; do not drop or dump pipe into trenches.
6. Use heavy canvas or nylon slings, not chains or cables, to lift pipe and fittings.
7. Cement-Mortar Lined Steel Pipe: Tightly close ends with polyethylene plastic wrap to protect cement-mortar lining during shipment; leave plastic wrap on pipe until installation.
8. Remove pipe that, in the opinion of the Engineer, is damaged beyond repair.

B. Gaskets

1. Store in a cool, well-ventilated area.
2. Do not expose to the direct rays of the sun.
3. Do not allow contact with oils, fuels, or petroleum solvents.

1.07 SYSTEM DESIGN REQUIREMENTS

A. General

1. The Specifications and Drawings are not all inclusive of explicit piping details; provide piping in accordance with laws and regulations and intended use, including:
 - a. Power Piping: ANSI/ASME B31.1-2002 Code.
 - b. Building Service Piping: ANSI/ASME B31.9-1996 Code, as applicable.
 - c. Uniform Plumbing Code.
 2. Pressure Ratings and Materials Specified: Represent minimum acceptable standards for piping systems.
 3. Piping Systems: Suitable for the services specified and intended.
- B. Buried Piping
1. Provide to be suitable for design conditions as follows: HS20 traffic loads (AASHTO Standard Specifications for Highway Bridges) with 1.5 impact factor. Designed for piping with and without internal pressure.
- C. Support Systems
1. Design, size and space supporting devices adequate to maintain the pipelines, appurtenances and equipment in proper position and alignment under all operating and testing conditions with allowances for expansion and contraction.
 2. Design all supporting devices to minimize interference with access and movement. Eliminate potential injuries due to protruding support devices.
 3. Select and design within the specified spans and component requirements.
 4. The absence of pipe supports and details on the Drawings shall not relieve Contractor of responsibility for sizing and providing supports throughout plant.
 5. Meet requirements of ANSI/MSS SP-58-2009, "Pipe Hangers and Supports-Materials, Design, and Manufacture."
 6. Criteria for Structural Design and Selection of Pipe Support System Components:
 - a. Dead loads imposed by the weight of the pipes filled with water, except air and gas pipes within specified spans and component requirements, plus any insulation.
 - b. Safety Factor: Minimum of 5.
 7. Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
 - a. Piping smaller than 30 Inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required.
 8. Framing Support Systems
 - a. Beams: Size such that beam stress does not exceed 25,000 psi and maximum deflection does not exceed 1/240 of span.
 - b. Column Members: Size in accordance with the manufacturer's recommended method.
 - c. Support Loads: Calculated for pipes filled with water.
 - d. Electrical Conduit Support: Include in design of framing support system.

9. Support Spacing for Piping: Design actual support spacing and rod size based on pipe strength, anticipated loads, configuration, and other considerations. Acceptable limits are shown on the drawings.

D. Thrust Restraint

1. Ties: Generally not shown on Drawings of the individual pipelines; their absence shall not relieve Contractor of the responsibility for providing them as required to provide complete systems for the use intended.
2. Buried thrust blocks shall not be used.

PART 2 PRODUCTS

2.01 GENERAL

A. Pipe Materials

1. General materials to be used for the piping systems are listed by service in the Piping Schedule at the end of this section.
2. Specific material requirements are specified in the Piping Specifications.
3. Like Items of Materials: End products of one manufacturer in order to achieve standardization for appearance, maintenance, and replacement.
4. Furnish grooved-end pipe fittings and couplings from the same manufacturer.

B. Components

1. Furnish new products of equal material and rating as connecting pipe.

C. Galvanizing

1. Hot-dip applied, meeting requirements of ASTM A153/A153M-03 except with an extra heavy coating thickness equal to minimum coating thickness Grade 85.
2. Hardware: Hot-dip galvanize process in accordance with ASTM A153/A153M-03.
 - a. Bolts, nuts and washers may be mechanically galvanized in accordance with ASTM B695.
 - b. Galvanize all components in connection utilizing the same galvanizing process.
 - c. Oversize threaded components in accordance with the respective ASTM specifications for the galvanizing process and material fabrication.
 - d. Lubricate nuts with a clean, non-oily and dry to touch lubricant. Provide lubricant with visible dye.
3. Electroplated zinc or cadmium plating is unacceptable.
4. Stainless steel components may be substituted where galvanizing is specified.
5. Repair methods should be in accordance with ASTM A780.

D. Shop Fabricated Piping

1. Furnish in accordance with approved layout drawings

2. Fabricate outlets and bends in appropriate lengths so that when installed they will be located as shown on layout drawings.
3. Mark each pipe and fitting on the outside to include:
 - a. Size or diameter and class of pipe
 - b. Manufacturer's identification and pipe serial number
 - c. Location number on layout drawing
 - d. Date of manufacture.
4. Where galvanizing is specified, hot-dip after fabrication in accordance with ASTM A123 and piping specifications.

E. Fittings

1. Manufacture fittings to standard dimensions and suitable for pressure specified. Provide fittings of the same or heavier wall thickness as the pipe of which they are a part.
2. Provide screwed and welded fittings meeting the requirements specified in the Piping specifications at the end of this section.
3. Provide fabricated steel fittings with plain end or welded flanges.
4. Where galvanized is specified, hot-dip galvanize after fabrication in accordance with ASTM A123 and piping Specifications.

F. Glass Lining

1. Glass lining shall be hard, smooth, continuous vitreous material formulated to resist the adherence of crystalline metal salt deposits in sludge and centrate lines.
2. The glass portion of the lining shall have a density of 2.5 to 3.0 grams per cubic centimeter when measured per ASTM D792.
3. The finished lining shall have the following characteristics:
 - a. Minimum dry film thickness of 10 mils when measured per ASTM D7901.
 - b. The lining shall withstand a strain of 0.001 inch/inch of the base metal without damaging the glass.
 - c. Minimum hardness of 5 of Moh's hardness scale.
4. Installation shall be completed in a twostep firing process including a ground coat and cover coat application.
5. Quality Assurance: Inspect each pipe/fitting prior to shipment, including:
 - a. Minimum lining thickness test to verify 10 mil thickness.
 - b. Holiday test using low voltage wet sponge testing apparatus per ASTM D5162. Allowable holiday indications are given below.

Fittings	Max # of Holidays	Pipe	Max # of Holidays*
N/A	N/A	3" diameter (maximum length 10')	6
4" through 8" diameter	5	4" through 8" diameter	12
10" through 18" diameter	8	10" through 18" diameter	20

*Except where noted, values are for 20' pipe lengths. For shorter lengths maximum holidays is proportional.

- c. Finished glass lined pipe straightness shall be 3/8" in 20 feet for flanged and grooved end pipe and 5/8" in 20 feet for bell and spigot pipe.
 - d. Applicator shall have a minimum of five years of experience in the application of high temperature coatings for the wastewater industry.
6. Welding and tapping of glass-lined pipe shall be completed prior to glass lining.

2.02 JOINT FOR EXPOSED PIPING

A. General

- 1. Furnish joints of the type specified in the Piping Specifications at the end of this Section.

B. Grooved-End Joints

- 1. Provide for exposed piping where shown on the drawings and as specified in the applicable Piping Specification.
- 2. Type: Rigid, except where joints are used to correct misalignment, to provide flexibility, and where shown otherwise, in which case provide flexible type.
 - a. Manufacturer shall be Victaulic or approved equal. Couplings shall be compatible with specified pipe material.
- 3. Provide fittings and couplings from same manufacturer to assure uniformity and compatibility of grooved-end piping components.

C. Flanged Joints: Use for pipe joints only as follows:

- 1. Grooved-end joints are not specified in the Piping Specification.
- 2. Grooved-end joints are not available, as on certain pipe sized and fittings.
- 3. Grooved joints are not permitted because of service.
- 4. Grooved-end Flange Adapter Manufacturer: Victaulic flange adapter.
- 5. Verify compatibility of pressure class, flange drilling, and mating flange to adapter flange gasket prior to selecting grooved end adapter flanging.
- 6. Provide all flanges for steel pipe of the slip-on welding type with hubs meeting the requirements specified in the Piping Specifications at the end of this section.
- 7. Provide for exposed steel pipe where specifically shown on the Drawings:
 - a. Provide flanged joints with bolts or bolt studs with a nut on each end.
 - b. Provide bolts, stud bolts and nuts meeting the requirements specified in Piping Schedule.
 - c. Provide bolts that have a 1/4-inch projection beyond the nut when joint with gasket is assembled.
- 8. Provide gaskets for flanged joints meeting the requirements specified in the Piping Specifications.
- 9. Dielectric Insulation: Provide dielectric insulating-flanged joints as required. Provide flange insulation kits to include flange insulating gasket, flange bolt insulating sleeves and flange bolt insulating washers.

D. Grooved-End Piping Compatibility

1. Provide fittings and couplings from same manufacturer to assure uniformity and compatibility of grooved-end piping components.

E. Dismantling Joint

1. All dismantling joints shall be designed, manufactured, and tested in accordance with the requirements AWWA C219 for bolted couplings.
2. The dismantling joint shall be a self-contained flanged restrained joint fitting, including both flanged components and sufficient harness bars to withstand the imposed thrust. The dismantling joint shall allow for up to 2-inches of longitudinal adjustment. The dismantling joint shall be rated at a pressure of 250 psi and flanges shall be in accordance with AWWA C207 Table D. The dismantling joint shall be furnished as a complete assembly consisting of spigot piece, flange adapter, tie bars and gasket. The dismantling joint shall be designed so that no part of the restraint system extends outside the flange diameter. The internal bore shall match that of the pipe system.
3. The spigot piece shall be made of steel to ASTM A283 Grade C. The flange adapter for pipe up to 12-inches in diameter shall be either steel to ASTM A283 Grade C or ductile iron to ASTM A536 Grade 65-45-12. The flange adapter for pipe greater than 12-inches in diameter shall be steel to ASTM A283 Grade C. Tie bars shall be ASTM A193 Grade B7 threaded rod with rolled threads. Gasket shall be EPDM Grade E in accordance with ASTM D2000. The dismantling joint shall be supplied with an in-house applied fusion bonded Epoxy or Rilsan Nylon coating applied by fluidized bed method. The coating shall comply with the requirements of AWWA C550 as applicable. Tie bars, nuts, and washers shall be zinc coated.
4. The dismantling joint shall comply with AWWA C219 where applicable. The manufacturer must have manufactured the dismantling joint for a minimum of 5 years. The gasket seal and compression stud and nut arrangement shall be independent of the tie rod restraint system. Tie rod diameter shall be compatible with the corresponding bolt diameter of the mating flange. The tie rod restraint system shall be capable of withstanding full pressure thrust that the pipe system can develop at no more than 50% of the yield strength of the tie rod material.
5. The dismantling joint shall be as manufactured by Smith-Blair, Inc., Romac, or engineer approved equal.

2.03 JOINTS FOR BURIED PIPING

A. Ductile Iron Pipe

1. Pressure Services:
 - a. Provide joint thrust restraint designed for test pressures shown in Piping Schedule.
2. Connection to Existing Piping System:
 - a. Use mechanical joint anchor gland follower where thrust ties.
 - b. Anchor type, wedge action, ductile iron with break-off tightening bolts.
 - c. Manufacturer: EBAA Iron, Inc., Megalug.

B. Steel Pipe

1. Gravity and Non-pressure Services: Provide flexible couplings or bell-and-spigot joints with constrained gaskets, as specified.
2. Pressurized Services: Provide joint similar to gravity and non-pressure services with thrust restraint.
 - a. Thrust Protection: Sustain force developed by 1-1/2 times operating pressure specified

2.04 EXPANSION JOINTS

A. Metal Expansion Joints

1. Stainless Steel Pipe Expansion Compensator where indicated on Drawings: Type 304 stainless steel single-ply unlaminated bellows with type 304 stainless steel flanges. Minimum working pressure 8.5-psig. Hyspan models 2505-067-3.0, 2505-080-3.0, 2505-084-3.0 or Engineer-approved equal bellows.
2. Carbon Steel Pipe Expansion Compensator where indicated on Drawings: Type 304 stainless steel single-ply unlaminated bellows with A-36 carbon steel plate flanges. Minimum working pressure 8.5-psig. Hyspan model 2505-080-3.0 or Engineer-approved equal bellows.

B. Rubber Expansion Joints

1. Elastomer bellows, reinforced, rubber spool type of a single, open wide-arch design.
2. End Connections: rubber flanged, 125-pound ANSI with split, galvanized steel retaining rings.
3. Washers: Over the retaining rings to help provide a leak-proof joint under test pressure.
4. Thrust Protection: Provide control rods to protect the bellows from over extension. The number and size of the control rods shall be sufficient for the maximum system test pressure.
5. Materials of Construction: Chlorobutyl, fiberglass, and Kevlar with EPDM lining and cover.
6. Bellows Arch Lining: Viton or EPDM. Arch lining shall be chemically compatible with fluid. See Elastomer materials listed in Valve Schedule (Specification 15100) for acceptable materials for specific chemical service; coordinate with Engineer.
7. Rated Temperature: 300 F for Viton and 250 F for EPDM.
8. Rated Deflection and Pressure: Lateral Deflection 3/4-inch minimum. Burst Pressure four times the working pressure.
9. Compression deflection and minimum working pressure as follows:

Size (inch)	Deflection(inch)	Pressure (psig)
2.5 to 12	1.06	7.5
14	1.65	7.5

10. Manufacturers and Styles: General Rubber Corp., Style 1015 Single Arch; Garlock, Style 204 Single Arch; Flexicraft Industries, Ultraspool, or Engineer-approved equal.

2.05 JOINT LUBRICANT

- A. Furnished with pipe.

- B. Amount and Type: As recommended by pipe manufacturer.
- C. Composition: Water soluble, nontoxic, vegetable soap compound conforming to United States Pharmacopoeia No. P39, suitable for use in potable waterlines.

2.06 PIPE GUIDES

A. Intermediate Guides

1. Piping 6 Inches and Smaller: Pipe clamp with oversize pipe sleeve to provide minimum 1/8-inch clearance as manufactured by Kin-Line, Inc., Figure 417 or Grinnell Power Strut, Figure P5932.
2. Piping 8 Inches and Larger: Specially formed U-bolts with double nuts to provide 1/4-inch minimum clearance around pipe. U-Bolt Stock Size shall be as follows:
 - a. 8-Inch Pipe: 5/8-inch U-bolt.
 - b. 10-Inch Pipe: 3/4-inch U-bolt.
 - c. 12 through 16-Inch Pipe: 7/8-inch U-bolt.
 - d. 18 through 30-Inch Pipe: 1-inch U-bolt.

B. Alignment Guides

1. Piping 8 Inches and Smaller: Galvanized steel spider or sleeve type.
2. Piping 10 Inches and Larger: Galvanized roller type guides as manufactured by Flexonics, or Kin-Line.

2.07 PIPE ANCHORS

- A. Galvanized steel anchor chair with U-bolt strap.
- B. Manufacturers and Models: Grinnell, Figure 198 or B-Line, Figure B3147A or B.

2.08 COUPLINGS FOR METALLIC PIPING

A. General

1. Thrust Ties: Provide where shown and where required to restrain the force developed by 1-1/2 times the test pressures specified.
 - a. Steel Pipe: Attach with fabricated lugs per AWWA Manual 11.
 - b. Flanged Coupling Adapters: Employ manufacturer's anchor studs through the coupling sleeve for exposed installations.
2. Exposed Installations: Zinc-plated nuts and bolts; however, high-strength, low-alloy steel, in accordance with AWWA C111, may be substituted for use on cast iron and ductile iron couplings.
3. Buried and Submerged Installations: Provide Type 304 stainless steel bolts and nuts.

B. Steel Sleeve Type Couplings

1. General

- a. Pressure Rating: Provide couplings with a minimum pressure rating equal to test pressure of the pipeline.
 - b. Middle Rings and Followers: Provide middle rings without pipe stop and at least 3/8 inch thick and 7 inches wide for 10 inch through 30 inch pipe and 1/2 inch thick and 10 inches thick for 36 inch and larger pipe. Provide middle rings manufactured of steel meeting requirements of ASTM A513.
 - c. Followers: provide followers manufactured of rolled AISI C1012 or C101B steel and of proper thickness.
 - d. Gasket Material: Use rubber compound gaskets that are not affected by the fluid service of the pipeline.
 - e. Bolting Hardware: Exposed Installations: Provide steel bolts and nuts meeting requirements of AWWA C111 or ANSI A21.11.
 - f. Coatings: Line and coat steel sleeve type couplings in accordance with Section 09 90 00. Coat all bolts, nuts and coupling after the joint has been made.
- 2. Flexible Couplings
 - a. Manufacturers for Steel Pipe: Dresser, Style 38; Smith Blair, Style 411.
 - b. Manufacturers for Ductile Iron Pipe: Dresser, Style 53 or 153; Smith Blair, Style 431.
 - 3. Transition Couplings: Connect similar pipe with small difference in outside diameter. Manufacturers: Dresser, Style 162; Rockwell, Style 413.
 - 4. Flanged Coupling Adapters
 - a. Manufacturers for Steel Pipe: Smith Blair, Series 913; Dresser Industries, Inc., Style 128.
 - b. Manufacturers and Models for Ductile Iron Pipe: Smith Blair, Series 912; Dresser Industries, Inc., Style 127.
 - c. Where restrained flanged coupling adapters are indicated on drawings, flanged coupling adapters shall be provided with factory installed anchor studs.

2.09 SERVICE SADDLES

A. Ferrous Metal Piping (Except Stainless Steel)

- 1. Double-strap design capable of withstanding 150 psi internal pressure without leakage or overstressing.
- 2. Run diameter compatible with the outside diameter of the pipe on which the saddle is installed.
- 3. Taps with iron pipe threads.
- 4. Malleable or ductile iron bodies and galvanized steel straps, steel hex nuts with washers, and neoprene seals.
- 5. Manufacturers: Dresser, Style 91, Smith Blair, Style 317.

B. Stainless Steel Pipe Service Branches

- 1. Provide as specified in the applicable Piping Specification.

C. Plastic Piping

1. Nylon-coated iron bodies with Buna-N seals and stainless steel clamps with stainless steel clamps and nuts. Manufacturer to be Smith Blair Model 315 or 317, or approved equal.

2.10 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Ductile Iron Wall Pipe

1. For penetrations through concrete walls, floors, slabs, or roofs that are to be watertight.
2. Diameter and Ends: Same as connecting ductile iron pipe.
3. Thickness: Equal to or greater than remainder of pipe in line.
4. Fittings: In accordance with the applicable Detail Piping Specification.
5. Provide taps for stud bolts in flanges set flush with wall face.
6. Seep Rings: Material and construction ductile iron or cast iron, cast integral with wall pipe wherever possible. Fabricated by welded attachment of ductile iron thrust collar to pipe where casting impossible. Perform in pipe manufacturer's shop by qualified welders as specified herein with electric arc welds of ductile iron with NI-55 or FC-55, nickel-iron-carbon weld rod. Continuously weld on each side all around.
7. Manufacturer: American Cast Iron Pipe Co. or approved equal

B. Steel or Stainless Steel Wall Pipe

1. Fabricate of same material and thickness as connecting pipe; however, minimum thickness of 1/4 inch is required.
2. Lining: Same as connecting pipe.
3. Seep Rings shall have outside diameter 3 inches greater than outside diameter of wall pipe and be continuously fillet welded on each side all around.

C. Pipe Sleeves

1. Fabricate of 3/16-inch minimum thickness steel pipe.
2. Above grade in Nonsubmerged Areas: Hot-dip galvanized after fabrication.
3. Below grade or in Submerged or Damp Environments: Lined and coated after fabrication as specified in Section 09 90 00.
4. Seep Ring: Provide 3/16-inch minimum thickness center flange for water stoppage on sleeves in exterior or water-bearing walls. Outside Diameter: 3 inches greater than wall pipe outside diameter. Continuously fillet weld on each side all around.
5. Existing Walls: Holes drilled with a rotary drill may be provided in lieu of sleeves.

D. Modular Mechanical Seal

1. Provide for existing wall penetrations by pipe sleeve as shown on the Drawings.
2. Type: Interconnected synthetic rubber links shaped and sized to continuously fill annular space between pipe and wall sleeve opening.
3. Assemble interconnected rubber links with Type 316 stainless steel bolts, nuts, and pressure plates.

4. Size modular mechanical seals according to manufacturer's instructions for the size of pipes shown to provide a watertight seal between pipe and wall sleeve opening, and to withstand a minimum hydrostatic head of 40 feet of water.

2.11 INSULATING FLANGES, COUPLINGS, AND UNIONS

A. General

1. Materials and Rating: In accordance with the applicable Piping Specification.

B. Dielectric Flange and Union

1. Dielectric flange and union manufacturers to be Epco Sales, Inc.; Capitol Insulation Unions.

C. Insulating Coupling

1. Insulating coupling manufacturers to be Dresser, STAB-39; R. H. Baker, Series 216.

2.12 PIPING SUPPORT SYSTEMS

A. General

1. Provide Contractor-designed system as specified herein.
2. Fabricate pipe supports of the correct material to general configuration indicated by catalogs when specified items are not available in specified material.
3. Manufacturers' catalog figure numbers are typical of the types and quality of standard pipe supports and hangers to be provided.
4. Special support and hanger details are shown to cover typical locations where standard catalog supports are inapplicable.
5. Concrete Anchors and Anchor Bolts: Type 316 SS.
6. Hanger and Support Materials, Type 304 or 316 stainless steel for following locations: Submerged or less than 1 foot above the liquid surface. Below tops of channel walls. Under covers or slabs of channels and tanks. In other damp locations.
7. Galvanized and painted pipe hanger and support materials, as specified in Section 09 90 00, at all other locations.
8. Submerged Metal Piping: Electrically isolate from supports with a wrap of 1/4-inch by 3-inch neoprene rubber between the pipe and oversize clamps.

B. Saddle Support

1. Pedestal Type: Schedule 40 steel pipe stanchion, saddle, and anchoring flange.
2. Nonadjustable saddle, MSS SP-69-2002, Type 37 with U-bolt: Grinnell, Figure 259; B-Line, Figure B3093.
3. Adjustable saddle, MSS SP-69-2002, Type 38 without clamp: Grinnell, Figure 264; B-Line, Figure B3092.
4. Neoprene Waffle Isolation Pad: Mason Industries, Type W; Korfund, Korpad 40.

C. Hangers

1. Hanger, MSS SP-69-2002, Type 1 and Type 6: Grinnell, Figure 104 or 260; B-Line, Figure B3198H or B3100.
2. Hanger Rods, Clevises, Nuts, Sockets, and Turnbuckles: In accordance with MSS SP-69-2002.
3. Attachments to Steel Beams: Concentric loading I-beam clamp, MSS SP-69-2002, Type 21, 28, 29, or 30 which engage both sides of the flange.
4. Concrete Attachment: Concrete inserts, MSS SP-69-2002, Type 18, continuous channel insert or clip angles with anchor bolts.
5. Welding Insulation Saddles: MSS SP-69-2002, Type 39 for insulated steel piping: Grinnell, Series 160; B-Line, Series B3160.
6. Insulation Shields: Galvanized steel and stainless steel, MSS SP-69-2002, Type 40: Grinnell, Figure 167; B-Line, Figure B3151.

D. Wall Brackets

1. One-hole clamp type: Grinnell, Figure 126.
2. Welded steel, MSS SP-69-2002, Type 33 (heavy-duty): Grinnell, Figure 199; B-Line, Figure B3607.
3. Channel Type: Unistrut; Kin-Line.

E. Pipe Clamps

1. Riser clamps, MSS SP-69-2002, Type 8: Grinnell, Figure 261; B-Line, Figure B3373.

F. Channel Type Support Systems

1. 12-gauge, 1-5/8-inch wide series, pre-galvanized in accordance with ASTM A525, Class G90, or hot-dip galvanized after fabrication or, when required by location, Type 304 stainless steel.
2. Members and Connections: Design for all loads with a safety factor of 5.
3. Manufacturers: Kin-Line, Series CI3812; Unistrut, Series P3200.

2.13 INSULATION

- A. In accordance with Section 33 14 13-3.17

2.14 CONCRETE

- A. Provide concrete encasement in accordance with Section 03 30 00.

2.15 TRENCH EXCAVATION AND BACKFILL

- A. As specified in Section 31 05 00.

2.16 HEAT TRACING SYSTEM

- A. See Section 22 07 00, if applicable.

2.17 TAPE WRAP

- A. Provide 15-mil butyl rubber adhesive, polyethylene-backed tape wrap system including appropriate primer, weld strip tape, filler tape, and tape layering in accordance with ANSI/AWWA C 209, C 214.
- B. Manufacturers: Tek-Rap, Inc.; Polyken Division of the Kendall Co.; Royston

2.18 PIPE MARKERS

- A. Markers shall be installed for all NEW utilities including but not limited to, all new electrical feeds and major ductbanks.
- B. Markers shall be provided and installed by the Contractor at all test station, bend, air release, valve, and blow-off locations, where none of these conditions exist the markers shall be placed at 250-foot intervals.
- C. Markers shall be Carsonite Utility Markers, red for electrical utilities.
- D. Each RED (electrical) marker shall have an adhesive decal as supplied by the marker post Manufacturer with the following lettering:

“CAUTION – ELECTRICAL CONDUIT; BEFORE DIGGING CALL 303-499-3675; TOWN OF SUPERIOR”

- E. Contractor shall submit the proposed marker post complete with adhesive decal to the Owner for review prior to installation.

2.19 PIPE TRACER WIRE

- A. Attach 12 gauge single strand copper tracer wire to pipe with 2-inch wide PVC tape. PVC tape shall be 10 mil and a minimum of 200% elongation and 25 psi tensile strength. Splicing of tracer wire shall be per manufacturer’s recommendation. The tracer wire shall run to a test station or valve box. All piping shall be within 500 feet of a test station. Location of test stations shall be coordinated with the Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Existing Pipe and Penetrations
 - 1. Prior to ordering materials, expose all existing pipes that are to be connected to new pipelines.
 - 2. Verify the size, material, joint types, elevation, horizontal location, and pipe service of existing pipes.
 - 3. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings before installing connecting pipes.

3.02 PREPARATION

- A. New Pipe and Fittings

1. Inspect before exposed pipe or fitting is installed or buried pipe or fitting is lowered into the trench.
2. Clean ends of pipe thoroughly, remove foreign matter and dirt from inside of pipe, and keep clean during and after laying.

B. Field Fabrication

1. Notify Engineer at least 2 weeks prior to fabrication of pipe or fittings and at least 3 days prior to start of any surface preparation or coating application work.

3.03 FIELD WELDING

A. General

1. In accordance with ANSI/AWWA C206.
 - a. All Piping: AWWA C206.
 - b. Heating and Cooling Water Services: ANSI B31.1.
 - c. Flammable Gas, LP Gas, Ammonia, Chlorine Liquid and Vapor, Engine Exhaust, and Compressed Air Services: ANSI B31.3-2001.
2. See the Piping Specifications for additional requirements.
3. Field welding permitted only on pipes in which linings will not be damaged by welding or in which linings are designed for field repair and inspection.

B. Identification of Welds

1. Mark each weld with a symbol that identifies the person who made the weld.

C. Surfaces

1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.

D. Alignment and Spacing

1. Align ends to be joined within existing commercial tolerances on diameters, wall thickness, and out-of-roundness. Root Opening of Joint: As stated in paragraph Procedure, below.

E. Procedure

1. Shielded Metal-Arc Process: Use for all field welding, unless otherwise approved or specified herein or in the Detail Piping Specifications.
2. Welding on Stainless Steel: Use direct current, reverse polarity, shielded metal-arc or gas metal-arc process; or, use direct current, straight polarity, gas tungsten-arc or gas metal-arc process, unless otherwise approved.
3. Do not perform welding if there is impingement of any rain, snow, sleet, or high wind on the weld area, or if the ambient temperature is below 32 degrees F.
4. Tack Welds: Remove completely prior to proceeding with welding if all following requirements are not met:
 - a. Tack welds performed by qualified welder using the same procedure as for the completed weld.

- b. Tack welds made with an electrode similar or equivalent to electrode to be used for first weld pass.
 - c. Not cracked or otherwise inconsistent.
5. Thoroughly clean each layer of deposited weld metal, including the final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.
 6. Surface Defects: Chip or grind out those that will affect the soundness of weld.
 7. Welds: Free of cracks, incomplete penetration, weld undercutting, excessive weld reinforcement, porosity slag inclusions, and other defects in excess of the limits prescribed in Chapter V of the specified ANSI Codes.
 8. Branch Connections: Fit and groove weld in accordance with the details described and shown in Chapter V of the specified ANSI Codes.

3.04 PIPING INSTALLATION

A. General

1. Install in conformance with reviewed shop drawings.

B. Piping Expansion Provisions

1. Piping: Install to allow for thermal expansion due to differences between installation and operating temperatures.
2. Anchors and Anchor Walls: Install as shown to withstand expansion thrust loads and to direct and control thermal expansion.
3. Pipe Guides: Install an intermediate pipe guide for every pipe at each metal channel framing support not carrying an anchor or alignment guide. Where pipe expansion joints are required, install pipe alignment guides adjacent to the expansion device and within four pipe diameters as shown.
4. Expansion Devices: Install devices as specified and at locations shown.

C. Piping Flexibility Provisions

1. Install thrust protection as specified.
2. Install flexible couplings and expansion joints for piping systems and at connections to equipment where shown.
3. Install additional pipe anchors and flexible couplings to facilitate piping installation, in accordance with reviewed shop drawings.

D. Pipe Fittings and Appurtenances

1. In accordance with the manufacturer's instructions and these Specifications.

3.05 FLEXIBLE COUPLINGS, FLANGED COUPLING ADAPTERS, GROOVED JOINT COUPLINGS, AND SERVICE SADDLES

- A. Thoroughly clean oil, scale, rust, and dirt from the pipe to provide a clean seat for the gasket.
- B. Wipe gaskets clean prior to installations.

- C. Lubricate flexible couplings and flanged coupling adapter gaskets with soapy water or manufacturer's standard lubricant before installation on the pipe ends.
- D. Install couplings, service saddles, and anchor studs in accordance with manufacturer's instruction.
- E. Tighten bolts progressively, drawing up bolts on opposite sides a little at a time until all bolts have a uniform tightness.
- F. Use only torque-limiting wrenches to tighten bolts. Torque setting shall be in accordance with manufacturer's written recommendations or applicable standards, whichever is more stringent.

3.06 INSULATING FLANGES, COUPLINGS, AND UNIONS

A. General: Install at following locations:

1. Copper and ferrous metal piping connections.
2. Cathodically protected piping penetration to buildings, and watertight structures.
3. Submerged metallic piping and unsubmerged piping connections.
4. Stainless and carbon steel connections
5. Where shown on the Drawings.

B. Flange Drillings for Installation of Insulating Kits

1. Drill oversize to accommodate insulating sleeves through the drilling using standard bolt sizes.

C. Insulated Joints

1. Insulating joints connecting immersed piping to non-immersed piping shall be installed above maximum water surface elevation and before the first pipe support not having coated anchor bolts or adhesive-bonded concrete anchors. All submerged carbon steel, ductile iron, or galvanized piping in reinforced concrete basins shall be isolated from the concrete reinforcement

3.07 PIPING SUPPORT SYSTEMS

A. General

1. Install Contractor-designed and selected support system, as approved, in accordance with Manufacturers Standardization Society of the Valve and Fitting Industry, Inc. (MSS) SP-69-2002, "Pipe Hangers and Supports-Selection and Application" and as specified herein.
2. Support piping connections to equipment by pipe support and not by the equipment.
3. Support large or heavy valves, fittings, and/or appurtenances independently of connected piping.
4. Support no pipe from the pipe above it.
5. Provide supports at piping changes in direction or in elevation, adjacent to flexible joints and couplings, and where otherwise shown.
6. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.

7. Vibration Isolation Pad: Provide for pedestal type pipe supports under base flange adjacent to equipment and where required to isolate vibration.
8. Insulation Piping: Install oversized supports to fit the closed-cell rigid insulation inserts. Install supports with galvanized or stainless steel protection shields and oversized rollers.
9. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing.
10. Dielectric Barrier: Provide between supports and copper or stainless steel pipe. Provide between stainless steel supports and non-stainless steel ferrous piping.
11. At each channel type support, provide every pipe with intermediate pipe guide, except where pipe anchors and alignment guides are required.
12. Channel Type Support Framing System Spacing: Install on 10-foot maximum centers, unless otherwise shown. Generally satisfactory for steel and ductile iron pipe 3 inches and larger. Other pipelines and special situations will require supplementary hangers and supports.

B. Support Methods

1. Horizontal Suspended Pipes:
 - a. Single Pipes: Adjustable swivel-ring, split-ring, or clevis hangers.
 - b. Multiple Pipes: Trapeze hangers with channel type supports.
2. Horizontal Pedestal Mounted: Saddle type supports.
3. Horizontal Wall Mounted: Wall brackets.
4. Vertical Pipes: Wall brackets, base elbows, or riser clamps on floor penetrations.

3.08 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Ductile Iron, Steel, and Stainless Steel Wall Pipes

1. Isolate embedded metallic piping from concrete reinforcement using coated pipe penetrations as specified in Section 09 90 00.
2. Support wall pipes securely by formwork to prevent contact with reinforcing steel and tie-wires.

B. Steel Pipe Sleeves

1. Above grade in Non-submerged Areas: Hot-dipped galvanized after fabrication.
2. Below grade or in Submerged or Damp Environments: Lined and coated as specified in Section 09 90 00.
3. Support non-insulating type securely in formwork to prevent contact with reinforcing steel and tie-wires.

C. New Penetrations of Existing Slabs, Floors, Walls and Roofs

1. Except as otherwise noted, core drill openings of diameter required to accommodate pipe penetration system.
 - a. When Drawings indicate existing reinforcement to remain, locate reinforcement with pachometer prior to coring. Adjust core location as required to avoid damage to reinforcement.

- b. Clean opening surfaces of coring residue.
 - c. When penetration is below tank liquid level, patch voids or discontinuities in the opening that would prevent obtaining watertight seal of the mechanical seal.
- 2. Install type of seal system between pipe and opening indicated on the Drawings.
- 3. Modular mechanical expanding rubber seal:
 - a. Install as per manufacturer's recommendations.
- 4. Grouted penetration:
 - a. Fill and pack annular space between pipe and opening with non-shrink grout. Finish grout flush with face of opening when backer rod and sealant are not required.
 - b. Install backer rod and sealant at face of opening when indicated.

3.09 TRENCH EXCAVATION AND BACKFILL

- A. In accordance with Section 31 05 00.

3.10 BURIED PIPE PLACEMENT

- A. General

- 1. Lay pipe and fittings in conformance with reviewed laying drawing, manufacturer's instructions and alignment and elevations shown.
- 2. Provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation.
- 3. Use pipe joint lubricant as specified; no substitutions will be permitted.
- 4. Do not lay pipe in water or when, in the opinion of the Engineer, trench conditions are unsuitable.
- 5. Prevent uplift and floating of pipe prior to backfilling.
- 6. Minimum Pipe Cover: 5 feet unless otherwise shown.
- 7. Do not deviate more than 1 inch from line or 1/4 inch from grade for gravity piping.
- 8. Measure for grade at the pipe invert, not at the top of the pipe.
- 9. Before laying each section of the pipe, check the grade with a straightedge and correct any irregularities found.
- 10. Dig bell holes at joint locations of ample dimensions in the bottom and sides of the trench where necessary to permit visual inspection and testing of the entire joint.
- 11. Prevent foreign material from entering pipe at all times during placement.
 - a. If pipe cannot be placed without foreign material entering pipe, place a tightly woven canvas bag snugly over each end before lowering pipe.
 - b. Leave bags in-place until connection is made to adjacent pipe.
- 12. Lay pipe upgrade with bell ends pointing in direction of laying.
- 13. After a section of pipe has been lowered into the prepared trench, clean the end of the pipe to be joined, the inside of the joint, and the rubber ring immediately before joining the pipe.

14. Check gasket position with feeler gauge furnished by the pipe manufacturer to assure proper seating. Feeler Gauge shall be of proper size, type, and shape for use during installation for each type of pipe furnished.
15. Install closure sections and adapters for gravity piping at locations where pipe laying changes direction.
16. After the joint has been made as specified under Section 2.3 and Section 3.10, subsections 3.10B and 3.10C, check pipe for alignment and grade. Maximum Deviation: 2 inches from line, and 1/2 inch from grade.
17. Joint Deflection:
 - a. Deflect pipe at joints for pipelines laid on a curve, using unsymmetrical closure of spigot into bell.
 - b. Maximum Deflection: 75 percent of maximum deflection recommended by pipe manufacturer.
 - c. Use one of the following methods if joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment: Shorter pipe lengths, special mitered joints, or standard or special fabricated bends.
 - d. Install thrust restraint if special mitered joints or bends are used.
18. Do not vary actual horizontal position of pipe centerline on alignment around curves by more than 1.5 feet from position shown.
19. Apply sufficient pressure in making the joint to assure that the joint is "home," as defined in the standard installation instructions provided by the pipe manufacturer.
20. Place sufficient pipe zone material to secure the pipe from movement before the next joint is installed.
21. Keep trench dry until the pipe laying and jointing are completed.
22. Close and block the open end of the last laid section of pipe-to prevent entry of foreign material or creep of the gasketed joints at all times when laying operations are not in progress, at the close of the day's work, or when the workers are absent from the job.

B. Bell-And-Spigot with Rubber Gasket Joints (Push-On Joints)

1. Assemble in accordance with manufacturer's instructions, and the following:
 - a. As next section of pipe is being readied for laying, clean bell of previously laid pipe of foreign material and apply thin film of specified lubricant to entire surface of bell ring.
 - b. At same time, lubricate gasket and install in spigot groove.
 - c. Ensure gasket tension is uniform around groove before placing pipe in trench.
 - d. Lower pipe section into trench until approximately in line with previously laid pipe section and spigot is centered in bell.
 - e. Force pipe "home" as defined in manufacturer's installation instructions and secure to proper alignment and grade with specified pipe zone material.
 - f. Check gasket position with feeler gauge, furnished by pipe manufacturer, to assure proper seating.
2. Flexible Couplings:
 - a. Before coupling, clean pipe holdback area of oil and dirt.
 - b. Remove pipe coating only if necessary to present smooth surface.

- c. Preferably, do not remove pipe coating; repair if damaged before joint is made.
 - d. Install couplings in accordance with manufacturer's instructions.
 - e. Clean gaskets before installation and, if necessary, lubricate with gasket lubricant for installation on pipe ends.
 - f. Tighten coupling bolts progressively, drawing up bolts on opposite sides a little at a time until all bolts have uniform tightness. Tighten bolts with torque-limiting wrenches; do not overstress bolts to compensate for poor alignment of flanges.
3. Connections to Concrete Structures:
- a. Make as shown.
 - b. If connection is not shown, locate standard pipe joint no more than 24 inches from structure.
- C. Concrete, Ductile Iron, and Polyvinyl Chloride (Gravity) Pipe
- 1. Join pipe in accordance with manufacturer's instructions.
 - 2. Joint Gaps for Concrete Pipe and Mortar Lined Ferrous pipe: Maximum of 3/8-inch wide inside piping 21 inches in diameter and smaller.
 - 3. For pipe Concrete and Mortar Lined Ferrous pipe of 24 inches nominal diameter and larger, fill and seal with premixed mortar and trowel smooth on the inside surface.
- 3.11 CONNECTING DISSIMILAR PIPE
- A. Flexible Transition Couplings: Install in accordance with pipe manufacturer's instructions.
- 3.12 BURIED PIPE IN CONCRETE ENCASEMENTS OR CONCRETE BEDDING
- A. Pipe Coatings: Continuous through concrete encasements, anchors, collars, etc., unless otherwise shown.
- 3.13 FLEXIBLE JOINTS AT CONCRETE BACKFILL OR ENCASEMENT
- A. Install flexible pipe joint within 18 inches or 1/2 the pipe diameter, whichever is less, from the terminations of any concrete backfill or concrete encasement, except for welded pipe joints.
- 3.14 FLEXIBLE JOINTS AT CONCRETE STRUCTURES
- A. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded pipe joints are not.
- B. Provide flexible joints at the face of all structures, whether or not shown.
- C. Joint may be flush with face or may be up to one pipe diameter away from face, but not further than 18 inches away from face.
- D. Install a second flexible joint for:
- 1. Pipelines Smaller than 18 Inches in Diameter: Within 18 inches of the first joint.
 - 2. Pipelines Larger than 18 Inches in Diameter: Within one pipe diameter of the first joint.

3.15 CLOSURES

A. Closure Pieces

1. Install as necessary to complete closure assembly where pipes meet other pipes or structures.
2. Elastomer sleeves bonded to pipe ends are not acceptable.

B. Pressure Pipeline Closures

1. Plain end pieces with double flexible couplings, unless otherwise shown or approved

C. Restrained Joint Pipe Closures

1. Install with thrust tie-rod assemblies in accordance with NFPA No. 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

D. Gravity Pipe Closures

1. As specified for pressure pipelines. Concrete closures may be used only when approved by the Engineer.

E. Concrete Closures

1. Provide with smooth interior surfaces conforming to pipe surface and construct using forms. Forms must be removed.
2. Locate away from structures so that there are at least two flexible joints between the closure and pipe entering the structure.

3.16 THRUST RESTRAINT

A. Location

1. At pipeline tees, plugs, caps, bends, and other locations where unbalanced forces exist. Ties shall be installed where required, whether or not shown.

B. Mechanical Joint Valves in Proprietary Restrained Joint Pipe and Fitting

1. Restrain mechanical joints with the proprietary restrained joint manufacturer's adapter gland follower and pipe end retainer or provide thrust tie-rods and socket clamps. Multiplied by the chord length for the curve along the centerline of the fitting.

3.17 INSULATION

A. All insulation, accessories, and supplies shall have fire-hazard classification ratings in accordance with NFPA 220, NFPA 255, ASTM E84, or UL723. Maximum flame spread rating shall be 25 and maximum smoke developed rating shall be 50.

B. Adhesives, sealants, facings, and vapor barriers shall be impervious to moisture.

C. ACCEPTABLE MANUFACTURERS

1. Johns-Manville

2. CertainTeed
 3. Armstrong
 4. Owens-Corning
 5. Knauf
- D. Adhesives, Coatings, and Sealants:
1. Foster
 2. Chillers Product Company
- E. Pipe Insulations
1. Glass Fiber:
 2. Rigid, molded, noncombustible, conforming to ASTM C547
 3. K value: 0.23 at 75 degrees Fahrenheit
 4. Service temperature rating: Minimum of 850 degrees Fahrenheit
 5. Vapor retarder jacket: Pressure sensitive, self-sealing tape lap system of white Kraft paper reinforced with glass fiber yarn and bonded to aluminum foil (Foil Scrim Kraft)
 6. Johns-Manville Micro-Lok, APT 2000
- F. Field Applied Pipe and Fitting Jacketing
1. PVC Plastic
 - a. One-piece, molded type, gloss white finish with fiberglass insulation insert for fittings
 - b. Johns-Manville Zeston 2000 (indoors)
- G. General Installation
1. Install insulation tightly over clean, dry surfaces which are free of foreign materials. Butt all edges firmly together.
 2. Install insulation only after piping, ducts, and equipment have been tested and approved by the authorities have jurisdiction, and after all other tests and certifications which are required by the specifications have been satisfactorily completed.
 3. Install pipe and duct insulation and vapor barriers continuous through wall and floor openings except where the penetrated surfaces or assemblies are fire-resistance rated. Maintain fire-resistance ratings of penetrated surfaces and assemblies.
 4. Install insulation on cold surfaces with a continuous, unbroken vapor seal. Insulate and vapor seal supports and anchors which are directly secured to cold surfaces.
 5. Finish all exposed raw edges of insulation with finishing cement.
 6. Do not use staples on vapor barrier jackets. Where staples must be used, thoroughly seal the vapor barrier penetrations with a white vapor-barrier finish. Use of staples must be approved by the Engineer prior to installation.
 7. Do not weld insulation support pins to pressure vessels.
 8. Leave all insulation surfaces dry and clean, and ready for subsequent work.

H. Installation of Piping Insulation

1. Unless noted otherwise, install insulation and covers with seams in the least visible location.
2. Neatly finish insulation at supports, protrusions, and interruptions.
3. Verify that piping wells, taps, and P & Ts are extended so that they will be flush with the surface of the finished insulation.
4. For insulated dual-temperature piping systems and for insulated piping which conveys fluids of a temperature which is less than the ambient temperature, provide vapor-retardant jacket with self-sealing lap joints. Insulate the complete systems.
5. For insulated piping which conveys fluids of a temperature which is greater than the ambient temperature, provide jacket with or without vapor barrier, with self-sealing lap joints. Bevel and seal ends of insulation at equipment, flanges, and unions.
6. For exterior applications, cover insulated pipe with Johns-Manville Zeston 2000 PVC or equivalent, or aluminum jacket. Locate jacket seams on bottom side of horizontal piping. Seal jacket watertight.

I. Installation of Insulation on Piping System Components

1. For all insulated piping systems, provide precut or premolded insulation shapes for all fittings, flanges, couplings, valves, and pipe terminations. Provide one-piece PVC covers equivalent to Johns-Manville Zeston 2000.
2. Precut or premolded insulation shall be applied to components using two layers for pipe temperatures above 250 degrees Fahrenheit or below 35 degrees Fahrenheit. Single layer insulation is acceptable between 35 degrees Fahrenheit and 250 degrees Fahrenheit. The ends of the precut or premolded insulation shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering, tufted and tucked in, fully insulating the pipe fitting. Covers shall overlap the adjoining pipe insulation and jackets, and on cold pipes shall be sealed at all seam edges with vapor barrier adhesive. Seal circumferential edges of all covers with pressure sensitive vinyl tape. The tape shall overlap the jacket and the cover at least one inch.
3. At locations where PVC covers are prohibited, the Contractor may use as an alternate one of the following methods: aluminum covers, one coat insulation cement, premolded fiberglass fitting covers, or mitered segments of pipe insulation. Finish for non PVC or aluminum shall be glass fabric embedded in fire retardant mastic lapped 2 inches over piping insulation. Finish with second coat of mastic. Mastic shall be vinyl acrylic mastic for hot piping and shall be vapor barrier mastic for cold piping.
4. Valves and may be insulated with sections of Fiberglass pipe insulation complete with All Service Jacket. Raw ends shall be coated with vinyl acrylic mastic for hot water valves and in-line pumps or vapor barrier mastic for in-line chilled water pumps and valves.

J. Pipe Insulation Schedules

1. Fiberglass

PIPE INSULATION SCHEDULE						
Minimum Pipe Insulation (inches)						
Fluid Design Operating Temperature Range (°F)	Mean Rating Temperature of Insulation	Nominal Pipe Diameter (inches)				
		<1	1 to 1 1/2	1 1/2 to <4	4 to <8	8 & up
Blower Discharge Piping, Inside Process Building						
		1.0	1.0	1.0	1.0	1.0

3.18 TAPE WRAP FOR BURIED STEEL AND COPPER PIPE

- A. Field Applied: In accordance with manufacturer's instructions and as specified herein
- B. Fully meet the requirements of ANSI/AWWA C 209, C 214.

3.19 MARKING TAPES WIRE

- A. In accordance with manufacturer's recommendation. Coordinate test point locations with Engineer and Owner.

3.20 EXPOSED PIPING INSTALLATION

A. General

1. Install parallel to building lines, unless shown otherwise.
2. Align hangers supporting adjacent piping with equal support spans where possible.
3. Install piping without springing or forcing of the pipe which would create stresses in the pipe, valves, or connected equipment.
4. Use torque-limiting wrenches to tighten bolts.
5. Straight runs of piping upstream and downstream of flow measuring devices shall be smooth.

B. Pipe Flanges

1. Set level, plumb, and aligned.
2. Install flanged fittings true and perpendicular to the axis of the pipe.
3. Bolt holes shall straddle vertical centerline of pipes.
4. Plastic Flanges: Bolt up, using a filler gasket, at any joint with a raised face. The filler gasket shall bear the bolt load uniformly and remove the flange moment from that part of the flange protruding beyond the outer edge of the raised face.

C. Unions

1. Install where required for piping or equipment installation.

D. Valve Orientation

1. As shown where valve handwheels are shown.
2. Where valve handwheels are not shown, orient to permit easy access to the valve operator, and to avoid interference.

E. Pipe Tap Connections

1. Taps to the pipe barrel are unacceptable.
2. To Ductile Iron Piping: Connect only with service saddle or at a tapping boss of a fitting, valve body, or equipment casting.
3. To Steel Piping: Connect only with a welded threadolet connection.

3.21 VENTS AND DRAINS

- A. Vent the high points and drain the low points of pipelines as shown.

3.22 PIPE IDENTIFICATION, PAINTING, AND COLOR CODING

- A. As specified in Section 09 90 00.
- B. Apply painting and color coding to the exterior covering of insulated piping.

3.23 CORROSION PROTECTION

A. General

1. Protect all pipe and piping accessories from corrosion and adverse environmental conditions.
2. Additional requirements for protection to those specified below are included in the Detail Piping Specifications and in Section 09 90 00.
3. Galvanize in accordance with Division 5.

B. Buried or Encased Carbon Steel or Copper Piping

1. Tape coated. Steel pipe shall be prepared and coated in accordance with ANSI/AWWA C 209, C 214 and manufacturer's recommendations, and these specifications. Copper piping shall be coated in accordance with manufacturer's recommendations and these specifications.
2. Solvent clean, SSPC-SP 1, pipe surface and wire brush, SSPC-SP 3, to remove dirt, loose rust, and mill scale.
3. Immediately prime with tape manufacturer's recommended primer in accordance with manufacturer's instructions.
4. Spirally apply tape to pipe, with minimum 50 percent overlap, after primer has thoroughly dried.
5. Joints: Tape wrap or heat shrink wrap. Complete joints above grade or excavate a sufficient size hole beneath couplings to permit joint wrapping without contamination of joint and wrap.

C. Buried or Encased Ductile Iron and Cast Iron Soil Pipe

1. Wrap buried ductile iron and cast iron soil piping with specified polyethylene encasement.
2. Install encasement in accordance with AWWA C105/ANSI A21.5 and manufacturer's instructions.
3. Do not provide polyethylene encasement for concrete encased pipe.

D. Buried Piping Accessories

1. Provide corrosion protection for ferrous metal piping appurtenances.
2. Tie-Rods and Similar Items: Coat with mastic coal tar epoxy.
3. Flange Bolts, Nuts, and Similar Items: Coat with mastic coal tar epoxy.
4. Flexible Couplings, Grooved Couplings, and Similar Items: Coat with mastic coal tar epoxy.
5. Buried Valves and Similar Elements on Wrapped Pipelines Coat with mastic coal tar epoxy.
6. Ductile Iron or Nonmetallic Pipelines: Exposed Nuts and Bolts Coat with mastic coal tar epoxy. Valves, wrap entire valve in 8-mil polyethylene as specified for ductile iron pipe.

E. Atmospheric Exposed Pipe

1. Copper Pipe: Paint as specified in Section 09 90 00. Apply paint prior to insulating.
2. Ductile Iron Pipe: As specified in Section 09 90 00.
3. Piping Accessories: Paint atmospheric exposed surfaces of black and hot-dip galvanized steel, brass, copper, and bronze piping components as specified in Section 09 90 00, as applicable to the base metal material. Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.

F. Submerged Pipe

1. Carbon Steel Piping: Clean and repair abraded areas of coatings on carbon steel pipe to be submerged or embedded, to provide a protective covering equal to original. Coat exterior of submerged or embedded carbon steel as specified in Section 09 90 00.
2. Ductile Iron and Cast Iron Soil Pipe: Coat as specified in Section 09 90 00. Clean and repair all abraded areas of coal-tar epoxy coatings on ductile iron or cast iron soil pipe to be submerged or embedded, to provide a protective covering equal to the original and acceptable to the Engineer.

3.24 PIPE LEAK TESTING

A. General

1. Conduct pressure and leakage tests on newly installed pipelines and appurtenances, in accordance with reviewed testing plan.
2. Furnish necessary equipment and material and make taps in piping, as necessary for testing and as specified.
3. Engineer or Owner will observe the tests.
4. Provide 14 days advance written notice of start of testing to Engineer and Owner.

5. Test Pressures and Type of Test: As specified in the Piping Schedule.
 6. Separately test pressure pipe sections that can be isolated by valves.
- B. Test Records: Make records of each piping system during the test to document the following:
1. Date of test.
 2. Description and identification of piping tested.
 3. Test fluid.
 4. Test pressure.
 5. Remarks, including: Leaks (type, location), repairs made on leaks, certification by Contractor and signed acknowledgment by Engineer or Owner that tests have been satisfactorily completed.
- C. Testing New Pipe Connected to Existing Pipe
1. Isolate new pipe with grooved-end pipe caps or blind flanges.
 2. Test joint between new piping and existing piping by methods, approved by the Engineer, that do not place the entire existing system under test load.
- D. Buried Pressure Piping
1. Initial Service Leak Test: Conduct with partially backfilled trench and joints left open for inspection, as field conditions permit and as approved by Engineer.
 2. Final Hydrostatic Acceptance Test: Conduct after trench has been completely backfilled.
 3. Expose all joints on buried pressure piping to be pneumatically tested or subjected to an initial service leak test.
- E. Exposed Pressure Piping
1. Conduct tests after piping has been completely installed and inspected for proper installation - including all supports, hangers, and anchors - prior to installation of insulation.

3.25 HYDROSTATIC LEAK TESTING

A. Procedure

1. Use water as the hydrostatic test fluid.
2. Provide clean, potable test water of quality necessary to prevent corrosion of the materials in the piping system.
3. Open vents at all high points of the piping system to purge air pockets while the piping system is filling.
4. Venting during filling may also be provided by loosening flanges with a minimum of four bolts or by the use of equipment vents.
5. Test all parts of the piping system at the test pressure specified.
6. Maintain hydrostatic test pressure continuously for 120 minutes minimum and for such additional time as necessary to conduct examinations for leakage.

7. Examine all joints and connections for leakage.
8. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leaking.
9. Correct visible leakage and retest.

B. Buried Pressure Piping

1. Per AWWA M11.
2. Cement-Mortar Lined Piping: Slowly fill test section with water and allow to stand for 24 hours under low pressure to allow cement-mortar lining to absorb water.
3. Expel all air from piping system prior to testing.
4. Apply and maintain specified test pressure with hydraulic force pump.
5. Valve off the piping system when test pressure is reached.
6. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.

3.26 PNEUMATIC LEAK TESTING

A. Limitations: Do not pneumatically test the following piping:

1. PVC or CPVC.
2. Piping larger than 2 inches, except as provided in paragraph 3.28 TESTING GRAVITY SEWERS.

B. Procedure

1. Perform pneumatic testing using accurately calibrated instruments and oil-free, dry air.
2. Perform tests only on exposed piping.
3. Test all parts of the piping system at the test pressures specified.
4. Secure piping to be tested to prevent damage to adjacent piping and equipment in event of a joint failure.
5. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by test.
6. Apply soap bubbles to joints and connections for examining leakage.
7. Apply maximum 25 psig preliminary pneumatic test to piping system prior to final leak testing, to locate visible leaks.
8. Correct visible leaks, and repeat the preliminary test until all visible leaks are corrected.
9. Gradually increase pressure in the system to not more than 1/2 of specified test pressure.
10. Thereafter increase pressure in steps of approximately 1/10 of specified test pressure, until required test pressure is reached.
11. Maintain pneumatic test pressure continuously for minimum 10 minutes and for such additional time as necessary to conduct a soap bubble examination for leakage.
12. Correct visible leakage and retest.
13. The piping system, exclusive of possible localized instances at pump or valve packing, shall show no visual evidence of leakage.

14. Following pneumatic testing and final cleaning, thoroughly purge lines which are to carry flammable gases with nitrogen to assure no explosive mixtures will be present in the system during the filling process.

3.27 TESTING GRAVITY SEWERS

A. General

1. Gravity sewers, including those designed to operate under surcharged conditions, shall be air tested as specified hereafter and visually examined for leaks.
2. Plug all wyes, tees, stubs, and lateral connections with gasketed caps or plugs securely fastened or tied to withstand the internal test pressure.
3. Such plugs or caps shall be removable, and their removal shall provide a bell suitable for making a flexible jointed lateral connection or extension.
4. Furnish all necessary testing equipment and perform the tests in a manner satisfactory to the Engineer.
5. Arrange testing equipment to provide observable and accurate measurements of leakage under the specified conditions.
6. Do not test sections of constructed sanitary sewer for acceptance until all connections, manholes, and backfilling are completed between the stations to be tested.

B. Procedure - Air Testing

1. After all plugs are in-place and securely blocked, introduce air slowly into the pipe section to be tested until the internal air pressure reaches 4 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe.
2. Allow a minimum of 2 minutes for the air temperature to stabilize.
3. Determine the height of the groundwater table at the time of the test.
4. Pipe and joints being air tested shall be considered satisfactory when tested at an average pressure of 3 pounds per square inch greater than the average back pressure of any groundwater that may submerge the pipe, and when: Total rate of air loss from the section being tested does not exceed 2 cubic feet per minute, and the section of line does not lose air at a rate greater than 0.0030 cubic feet per minute per square foot of internal pipe surface.
5. Upon completion of an air test, open a bleeder valve to allow air to escape; do not remove plug until all air has been released.
6. Do not allow any persons to enter trench or structure containing piping that is pressurized during an air test.

3.28 FINAL CLEANING

A. Interim Cleaning

1. Prevent accumulation of weld rod, weld spatter, pipe cuttings and filings, gravel, cleaning rags, and other foreign material within piping sections during fabrication.
2. Examine piping to assure removal of these and other foreign objects prior to assembly and installation.

- B. Following assembly and testing, and prior to disinfection and final acceptance, flush pipelines (except as stated below) with water to remove accumulated construction debris and other foreign matter.
 - 1. Plant process air, natural gas, chemical, and instrument air-lines shall be blown clean of loose debris with compressed air at 4,000 feet per minute. Do not flush these piping systems with water.
 - 2. Immediately after cleaning pipes, dry this piping with compressed air.
- C. Flush until all foreign matter is removed from the pipeline.
- D. Provide hoses, temporary pipes, ditches, and other items as required to properly dispose of flushing water without damage to adjacent properties.
- E. Minimum Flushing Velocity: 2.5 fps
- F. For large diameter pipe where it is impractical to flush the pipe at 2.5 fps velocity, clean the pipeline in-place from the inside by brushing and sweeping, then flush the line at a lower velocity.
- G. Insert cone strainers in the flushing connections to attached equipment and leave in-place until cleaning has been accomplished.
- H. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

3.29 DISINFECTION

- A. Disinfect the following Piping Services before placing in service in accordance with AWWA C653:
 - 1. Filtered Water (FW)
 - 2. Potable Water (PW)
 - 3. Sample Water (SP), off FW and PW systems only

3.30 PIPING SCHEDULE AND SPECIFICATIONS

- A. Following are a Piping Schedule and Piping Specifications that detail the piping systems used in this contract.

Piping Schedule

Service Legend	Service	Size Range, inches	Piping Specification	Test Pressure, psig	Test Type	Installation	Location, Inside/Outside	Notes
1W	Potable Water	≤ 3	COP1	250	HS	Exposed	Inside	
1W	Potable Water	≥ 4	CS1, DI1	250	HS	Exposed, Encased	Inside	
1W	Potable Water	≥ 4	CS2, DI2	250	HS	Buried	Outside	
3W	Non-potable Water	≤ 3	COP1	100	HS	Exposed	Inside	
3W	Non-potable Water	≤ 3	COP2	100	HS	Buried	Outside	
3W	Non-potable Water	> 4	CS1, DI1	100	HS	Buried	Outside	
D	Drain	< 2	GAL2	Match Pipe Test Pressure	HS	Exposed	Inside	Pipe drains/flushing connections, manual air releases. Insulate between dissimilar metals.
D	Drain	≤ 2	PVC2	100	HS	Exposed	Inside	
D	Drain	3	CS1	100	HS	Exposed	Inside	
D	Drain	≥ 4	PVC3	--	PN	Buried	Outside, beyond 5 feet of buildings	Test in accordance with Section 318, Uniform Plumbing Code
D	Drain	≥ 4	CISP	--	--	Exposed, buried or encased	Inside, and within 5 feet of buildings	Test in accordance with Section 318, Uniform Plumbing Code
D	Drain	3	PVC5, CISP	--	--	Buried or Encased	Outside	
NG	Natural Gas	> 1	PE1	5	PN	Buried	Outside	Install and test natural gas piping in accordance with 2012 International Fuel Gas Code. Test for a minimum of ½ hr per 500 cubic feet of pipe volume.
RAS	Return Activated Sludge	10 – 16	DI1	150	HS	Exposed, submerged, or encased	Inside	

Piping Schedule

Service Legend	Service	Size Range, inches	Piping Specification	Test Pressure, psig	Test Type	Installation	Location, Inside/Outside	Notes
RAS	Return Activated Sludge	≥ 12	DI2	150	HS	Buried	Outside	
SS	Sanitary Sewer	≥ 4	DI2	100	HS	Buried or Encased	Outside	
STM	Storm Sewer	<24	RCP	100	HS	Buried or Encased	Outside	
WW	Influent Wastewater	24	PVC4	100	HS	Buried or Encased	Outside	Influent wastewater sewer from headworks to anaerobic zones
V	Vent	2	CS3	25	HS	Exposed	Inside	Vents off RAS
V	Vent	2	CS3	25	HS	Exposed	Outside	Vents off RAS
WAS	Waste Activated Sludge	≤ 6	DI1	100	HS	Exposed	Inside	
WAS/SSC	Waste Activated Sludge and Secondary Scum	3	DI2	150	HS	Buried	Outside	
WW	Wastewater	All Sizes	DI2, CS2	100	HS	Buried	Outside	Wastewater pipe from anaerobic zones to existing secondary treatment basin

HS = Hydrostatic
 PN = Pneumatic

PIPING SPECIFICATION COP1 COPPER TUBING		
TUBING ≤ 3"	TYPE "L," COPPER HARD DRAWN ABOVE GROUND	ASTM B88
FITTINGS ≤ 3"	WROUGHT COPPER, SOLDER ENDS	ASTM B75 ANSI B16.22
UNIONS ≤ 3"	150# CAST BRONZE, SOLDER ENDS	ASTM B62
GASKETS	1/8" THICK EPDM, FULL FACE	50-60 DUROMETER
BOLTING	GALVANIZED OR CAD PLATED	ASTM A307 GR A
LINING	NONE	
COATING, EXPOSED	PER SECTION 09 90 00	
Notes: 1. Use lead free solder; ASTM B32 2. Use threaded adaptors for valves >1/2" use brass compression type fittings		

PIPING SPECIFICATION COP2 COPPER TUBING		
TUBING ≤ 3"	TYPE "K," COPPER HARD DRAWN BELOW GROUND	ASTM B88
FITTINGS ≤ 3"	WROUGHT COPPER, SOLDER ENDS	ASTM B75 ANSI B16.22
LINING	NONE	
COATING, BURIED OR ENCASED	TAPE WRAP BURIED PIPING	
Note: 1. Use lead free solder; ASTM B32		

PIPING SPECIFICATION CS1 CARBON STEEL - EXPOSED		
PIPE < 10"	SCH 40 CARBON, GRADE B, ERW OR SEAMLESS	ASTM A53 or ASTM A106
PIPE ≥ 10"	1/4" MIN. THICKNESS OR 3/8" MIN. THICKNESS	AWWA C200 OR ASTM A53, GRADE B
FITTINGS ≤ 2"	2,000# FORGED CARBON STEEL, SOCKET WELD OR TAPER THREADED	ASTM A105 ANSI B16.1 ANSI B.1.20.1
FITTINGS > 2"	BUTT WELDED, GROOVED END OR FLANGED	ASTM A234 GRADE WPB ANSI B16.9 AWWA C208
FLANGES > 2"	STEEL, SLIP ON, RING OR HUB TYPE. FLANGE CLASS (B OR D) PRESSURE RATING SHALL MEET OR EXCEED HYDROSTATIC TEST PRESSURE SHOWN IN PIPE SCHEDULE.	AWWA C207
COUPLINGS	SLEEVE TYPE; FOR AIR DISCHARGE PIPE: VICTAULIC (SEE NOTE)	
GASKETS	1/8" THICK, VITON, FULL FACE EXCEPT FOR NATURAL AND DIGESTER GAS: NEOPRENE; AND STEAM: SPIRAL WOUND, TYPE 304 SS WITH NONASBESTOS FILLER, FLEXITALIC STYLE CGD	50-60 DUROMETER
BOLTING	GALVANIZED OR CAD-PLATED	ASTM A307 GR B
UNIONS ≤ 2"	3,000# FORGED CARBON STEEL, SOCKET WELD, STEEL SEATS	ASTM A105
BRANCH CONNECTIONS ≤ 2"	2,000# WOG, FORGED CARBON STEEL, WELDED, SOCKET WELDED OUTLET	ASTM A105 GRADE II
BRANCH CONNECTIONS > 2"	STD. WEIGHT, FORGED STEEL, WELDING BRANCH FITTINGS	ASTM A105 GRADE II or AWWA C208

PIPING SPECIFICATION CS1 CARBON STEEL - EXPOSED		
LINING > 3" Except Piping Service BWS & BWW	CEMENT MORTAR	AWWA C205
LINING ≤ 3" AND ALL SIZES OF BWS & BWW SERVICES.	MODIFIED POLYAMINE EPOXY - SUITABLE FOR POTABLE WATER SERVICE and PIPES SMALLER THAN 4" (TNE MEC SERIES 22 or FC22) TOTAL DFT ≥40 MILS (See Section 09 90 00)	AWWA C210 NSF certified per ANSI/NSF Std 61
COATING	PER SECTION 09 90 00	
Notes: 1. Gaskets on all blower discharge piping shall be Victaulic Type L (Silicone, Temperature Range -30°F to 350°F) 2. No lining for air or gas service 3. Provide dielectric insulating flanges between dissimilar metals		

PIPING SPECIFICATION CS2 CARBON STEEL – BURIED		
PIPE < 10"	SCH 40 CARBON, GRADE B, ERW OR SEAMLESS	ASTM A53 or ASTM A106
PIPE ≥ 10"	1/4" MIN. THICKNESS OR 3/8" MIN. THICKNESS	ASTM A139 GRADE C OR ASTM A53, GRADE B
FITTINGS	BUTT WELDED	AWWA C208
COUPLINGS	SLEEVE TYPE; FOR AIR DISCHARGE PIPE: VICTAULIC (SEE NOTE)	
GASKETS	1/8" THICK, EPDM, FULL FACE EXCEPT FOR NATURAL AND DIGESTER GAS: NEOPRENE; AND STEAM: SPIRAL WOUND, TYPE 304 SS WITH NONASBESTOS FILLER, FLEXITALIC STYLE CGD	50-60 DUROMETER
BOLTING	GALVANIZED OR CAD-PLATED	ASTM A307 GR B
JOINTS	BUTT-WELDED OR DOUBLE LAP-WELDED	AWWA C200 AWWA C206
LINING > 3"	CEMENT MORTAR	AWWA C205
LINING ≤ 3" and AND ALL SIZES OF BWS & BWW SERVICES.	MODIFIED POLYAMINE EPOXY – SUITABLE FOR POTABLE SERVICE TOTAL DFT 20 MILS (TNEMEC SERIES FC22) MODIFIED POLYAMINE EPOXY - SUITABLE FOR POTABLE SEVICE TOTAL DFT >20 MILS (TNEMEC SERIES 22 or FC22)	AWWA C210 NSF Std. 61 AWWA C210 NSF Std. 61
COATING, BURIED OR ENCASED	POLYURETHANE PER SECTION 09 90 00	AWWA C222
Notes: 1. No lining for air or gas service 2. Gaskets on all blower discharge piping shall be Victaulic Type L (Silicone, Temperature Range -30°F to 350°F) 3. See test pressure in piping schedule for pressure requirements. 4. Provide dielectric insulating flanges between dissimilar metals		

PIPING SPECIFICATION CS3 CARBON STEEL (DRAIN SERVICE)		
PIPE ≤ 3"	SCH 40 CARBON, GRADE B, ERW OR SEAMLESS	ASTM A53 or ASTM A106
FITTINGS ≤ 3"	CAST IRON, THREADED DRAINAGE FITTINGS, GALVANIZED	ASTM A126 ANSI B16.12
LINING	NONE	
COATINGS: EXPOSED BURIED OR ENCASED	PER SECTION 09 90 00 TAPE WRAP 80 MILS	AWWA C214

PIPING SPECIFICATION D1 DUCTILE IRON-ABOVE GROUND		
PIPE	CENTRIFUGALLY CAST DUCTILE IRON	AWWA C151 or ANSI 21.51
FITTINGS	GRAY OR DUCTILE IRON 150 PSI MIN. EXCEPT 1W 250 PSI MIN. GROOVED ENDS-RIGID FLANGED-125 POUND ANSI STANDARD	AWWA C110, C153 ANSI B16.1 AWWA C606 AWWA C110
FLANGES	DUCTILE IRON-250 PSI WORKING PRESSURE, 125 POUND ANSI GROOVED END PIPE ADAPTER-MALLEABLE OR DUCTILE IRON	ANSI A21.15 AWWA C115 ASTM A47 ASTM A536
COUPLINGS	GROOVED ENDS PIPE COUPLINGS-RIGID	VICTAULIC STYLE 31 OR GUSTIN-BACON
BOLTING	GALV. OR CAD PLATED CARBON STEEL	ASTM A307 GR B
GASKETS	GROOVED END-FLUSH SEAL TYPE FLANGE GASKETS 1/8" THICK FULL FACE, 50-60 DUROMETER EXCEPT FOR NATURAL GAS USE FULL FACE 1/8"	ASTM D200 AWWA C606 VITON GARLOCK 7797, OR EQUAL
LINING	CEMENT-MORTAR LINING EXCEPT FOR DS, GR, and SSC SERVICES WHICH REQUIRE GLASS LINING	AWWA C104 ASTM B1000-21
COATINGS: ENCASED EXPOSED	1 MIL ASPHALTIC COATING PER SECTION 09 90 00	AWWA C151
Notes: 1. Use care not to damage cement lining 2. Provide dielectric insulating flanges between dissimilar metals		

PIPING SPECIFICATION DI2 DUCTILE IRON-BELOW GROUND		
PIPE	CENTRIFUGALLY CAST DUCTILE IRON 150 PSI MIN WORKING PRESSURE, 235 PSI SURGE	AWWA C151 or or ANSI 21.51
JOINTS	PUSH-ON, BELL AND SPIGOT, UNRESTRAINED - AMERICAN CAST IRON PIPE, FASTITE; US PIPE TYTON, OR EQUAL PUSH-ON, BELL AND SPIGOT, RESTRAINED - PROPRIETARY RESTRAINED; CLOW, SUPER-LOCK; AMERICAN CAST IRON PIPE; FLEX-RING OR LOK-RING; US PIPE TR FLEX, OR EQUAL OR EBAA IRON, INC. SERIES 1700, UNI-FLANGE SERIES 1450, OR EQUAL	AWWA C151, C111
FITTINGS	DUCTILE IRON 250 PSI MIN. MECHANICAL JOINTS, RESTRAINED EBAA IRON, INC. MEGALUG SERIES 1100 OR EQUAL OR PROPRIETARY RESTRAINED; CLOW, SUPER-LOCK; AMERICAN CAST IRON PIPE; FLEX-RING OR LOK-RING; US PIPE TR FLEX, OR EQUAL	AWWA C110, C153 AWWA C110, C111 and C153 AWWA C110
COUPLINGS	SLEEVE TYPE	
BOLTING	GALVANIZED OR CAD PLATED CARBON STEEL	ASTM A307 GR B
GASKETS	RUBBER EXCEPT FOR NATURAL GAS USE NEOPRENE	ANSI A21.11 AWWA C111
LINING	CEMENT-MORTAR LINING	AWWA C104 ASTM B1000-21
COATING	1 MIL ASPHALTIC COATING ENCASE BURIED PIPE AND FITTINGS WITH POLYETHYLENE FILM	AWWA C151
Notes: 1. Use care to not damage cement lining. 2. See test pressure in piping schedule for pressure requirements. 3. Provide dielectric insulating flanges between dissimilar metals		

PIPING SPECIFICATION GAL2 GALVANIZED STEEL		
PIPING < 1½"	SCH. 80 CARBON STEEL, GALVANIZED	ASTM A53 TYPE E or S, GRADE A or B
FITTINGS < 1½" AND BRANCH CONNECTIONS	CLASS 300 MALLEABLE IRON, GALVANIZED, SCREWED	ASTM A197
FLANGES	CLASS 300 FORGED STEEL, GALVANIZED FLAT FACE, SCREWED	ASTM A105
UNIONS < 1½"	CLASS 300 MALLEABLE IRON, GALVANIZED, SCREWED, BRASS SEATS	ASTM A197
NIPPLES < 1½"	SCH. 80 CARBON STEEL, GALVANIZED, THREADED ENDS	ASTM A106 GR B
PLUGS < 1½"	CLASS 300 MALLEABLE IRON, GALVANIZED, SCREWED, SQ. HD.	ASTM A197
GASKETS	FULL FACE, EPDM, 1/8" THICK	50-60 DUROMETER
BOLTING	GALVANIZED OR CAD-PLATED	ASTM A307, GR A
LINING	NONE	
COATING, EXPOSED	PER SECTION 09 90 00	
Notes: 1. Contractor shall have a licensed plumber confirm the piping system pressure capacity indicated in the Piping Schedule. 2. Contractor shall insulate. 3. Screwed connections: made by wrapping male thread with Teflon tape.		

PIPING SPECIFICATION PE1 POLYETHYLENE PLASTIC PIPE AND TUBING FOR NATURAL GAS		
PIPE AND TUBING	POLYETHYLENE GRADE PE2406 OR PE2708. MINIMUM CELL CLASSIFICATION 234373E.	ASTM D2513 ASTM D3350
FITTINGS	SOCKET TYPE BUTT FUSION ELECTROFUSION	ASTM D2683 ASTM D3261 ASTM F1055
Notes: 1. Install and test natural gas piping in accordance with the 2006 International Fuel Gas Code and manufacturer's written instructions. 2. Connections to metallic pipe meeting ASTM D 2513, ASTM F 1973, or ASTM F 2509.		

PIPING SPECIFICATION PVC1 POLYVINYL CHLORIDE		
PIPE ≤ 12"	SCH. 40 PVC	ASTM D1784
FITTINGS ≤ 12"	SCH. 40 PVC, SOLVENT WELD	ASTM D2466
GASKETS	FULL FACE TFE BONDED EPDM	ASTM D2466
FLANGES ≤ 12'	150# PVC SOCKET TYPE SCH 40	ASTM D2466
UNIONS ½" – 1½"	SCH. 40 PVC, SOCKET TYPE	ASTM D2466
NIPPLES ½" – 1½"	SCH. 40 PVC, MOLDED, THREADED ENDS	ASTM D2464
PLUGS ½" - 1½"	SCH. 40 PVC, SCREWED	50-60 DUROMETER
BOLTING	GALVANIZED OR CAD-PLATED	ASTM A307 GR A
LINING	NONE	
COATINGS: EXPOSED BURIED OR ENCASED	PER SECTION 09 90 00 NONE	
Notes: 1. Socket type connections: made using solvent welding cement ASTM D2564. 2. Piping, fittings, etc. Schedule 40 unless noted otherwise on the Drawings		

PIPING SPECIFICATION PVC2 POLYVINYL CHLORIDE		
PIPE ≤ 12"	SCH. 80 PVC	ASTM D1785
FITTINGS ≤ 12"	SCH. 80 PVC, SOLVENT WELD	ASTM D2467
GASKETS	FULL FACE VITON	50-60 DUROMETER
FLANGES ≤ 12'	150# PVC SOCKET TYPE SCH 80	ASTM D2467
UNIONS ½" – 1½"	SCH. 80 PVC, SOCKET TYPE	ASTM D2467
NIPPLES ½" – 1½"	SCH. 80 PVC, MOLDED, THREADED ENDS	ASTM D2467
PLUGS ½" - 1½"	SCH. 80 PVC, SCREWED	ASTM D2464
BOLTING	GALVANIZED OR CAD-PLATED	ASTM A307, GR A
LINING	NONE	
COATINGS: EXPOSED BURIED OR ENCASED	PER SECTION 09 90 00 NONE	
Notes: 1. Socket type connections: made using solvent welding cement ASTM D2564. 2. Piping, fittings, etc. Schedule 80 unless noted otherwise on the Drawings		

PIPING SPECIFICATION PVC3 POLYVINYL CHLORIDE		
PIPE: 4"-12"	PVC SDR 35	ASTM D3034
JOINING: 4"-12"	PUSH-ON WITH NITRILE GASKET	ASTM F477 ASTM D3212
FITTINGS: 4"-12"	PVC, ENDS TO MATCH PIPE	ASTM D3034
LINING	NONE	
COATINGS	NONE	

PIPING SPECIFICATION PVC4 POLYVINYL CHLORIDE		
PIPE: 4" - 36"	PVC SDR 35	ASTM D3034, TYPE PSM
JOINING: 4" - 36"	PUSH-ON BELL AND SPIGOT WITH NEOPRENE GASKET	ASTM D3212 ASTM D1689
FITTINGS: 4" - 36"	PVC, ENDS TO MATCH PIPE	ASTM D3034
LINING	NONE	
COATINGS	NONE	

PIPING SPECIFICATION PVC5 POLYVINYL CHLORIDE DWV		
PIPE ≤ 18"	SCH. 40 PVC	ASTM D1784
FITTINGS ≤ 18"	PVC DWV, THREADED OR SOLVENT WELD	ASTM D2665, D3311
FLANGES ≤ 18"	NA	
UNIONS ½" - 1½"	PVC DWV, THREADED OR SOLVENT WELD	ASTM D2665, D3311
NIPPLES ½" - 1½"	PVC DWV, THREADED OR SOLVENT WELD	ASTM 2665, D3311
PLUGS ½" - 1½"	PVC DWV, THREADED OR SOLVENT WELD	ASTM 2665, D3311
GASKETS	NONE	
BOLTING	NONE	
LINING	NONE	
COATING, EXPOSED	NONE	
COATING, BURIED OR ENCASED	NONE	
Notes: 1. Screwed connections: made by wrapping male thread with Teflon tape. 2. Socket type connections: made using solvent welding cement ASTM D2564. 3. Piping, fittings, etc. PVC DWV unless noted otherwise on the Drawings.		

PIPING SPECIFICATION RCP REINFORCED CONCRETE PIPE		
PIPE 12-96"	RCP	ASTM C76
JOINTS	BELL AND SPIGOT	
GASKETS	ELASTOMERIC RUBBER RING	ASTM C443

END OF SECTION

SECTION 40 05 59

HYDRAULIC GATES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish, install, start-up and test stainless steel slide gates complete with frames, operators and including all ancillary items and equipment as shown on the Drawings and as specified herein to provide a fully functioning system.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 and Section 11 00 00. The following additional submittals shall be provided in accordance with Section 01 33 00:
 - 1. Manufacturer data including design calculations confirming compliance with AWWA C560 or C561, leak and pressure rating, and torque required to use operators manually.

1.03 REFERENCES

- A. Industry standard references including but not limited to those listed shall be noted, as applicable, in this specification and shall be considered a part of this specification. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 - 1. ASTM A240 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel, and Strip for Pressure Vessels and for General Applications
 - 2. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes
 - 3. ASTM D4020 - Standard Specification for Ultra-High-Molecular-Weight Polyethylene Molding and Extrusion Materials
 - 4. ASTM F593 - Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs
 - 5. ASTM F594 - Standard Specification for Stainless Steel Nuts
 - 6. AWWA C561 - Fabricated Stainless Steel Slide Gates

1.04 QUALITY ASSURANCE

- A. Manufacturer's Experience: Manufacturer shall be one who has been regularly engaged in the business specified herein for at least 5 years. The equipment and all ancillary components shall be designed, supplied and warranted as a unit item by a single manufacturer or vendor.
- B. Warranty: As specified in Section 11 00 00.

1.05 EQUIPMENT SCHEDULE

- A. The equipment described in this specification shall conform to the requirements as indicated in the Slide Gate Schedule at the end of this Section.

1.06 SERVICE CONDITIONS

- A. Fluid temperature is expected to range from 35 to 75 degrees Fahrenheit.
- B. The equipment will be installed indoors and outdoors at a wastewater treatment plant in Superior, Colorado. All equipment furnished under this Section shall be suitable for outdoor installation.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Acceptable manufacturers for the stainless steel slide gates include Fontaine/ Rodney Hunt, Golden Harvest, Whipps Inc., or Engineer-approved equal.

2.02 MATERIALS FOR STAINLESS STEEL SLIDE GATES

Part	Material
Frame, retainers, guides, slide, yoke, stem guides, wall thimble	Stainless steel type 304L, ASTM A240; ASTM A276; or pipe material when connecting to a pipe
Stem, stem couplings	Stainless steel type 304, ASTM A276;
Lift nuts	Bronze, ASTM B584
Seat/seals and facing	Ultra-High Molecular Weight Polyethylene, ASTM D4020
Bottom closure seal or disc seal	Neoprene, polyethylene, or UHMW-PE, ASTM D4020
Fasteners and anchor bolts	Stainless steel type 304, ASTM F593 and F594, alloy group 1 or group 2; or ASTM A276
Pedestals and wall brackets	Stainless steel type 304, ASTM A276
Operator housing	Stainless steel type 304, ASTM A276, ASTM A312, or ASTM A376

2.03 PERFORMANCE REQUIREMENTS

- A. Stainless steel slide gates must meet the performance requirements of AWWA C561 latest revision. The gate must allow leakage of no more than 0.05 gallons per minute per perimeter foot in seating and unseating conditions.
- B. Gates shall be designed to withstand the design head listed in the Slide Gate Schedule.

2.04 GENERAL

- A. Gates shall meet the design requirements of AWWA C561 except as otherwise specified. Gates shall be of the heavy-duty type.
- B. Frame and Guide Rails
 1. The frame assembly, including the guide members, invert member and yoke members, shall be constructed of formed stainless steel plate with a minimum thickness of 1/4-inch.
 2. Frame design shall allow for embedded mounting, mounting directly to a wall with stainless steel anchor bolts and grout, or mounting to a wall thimble with stainless steel mounting studs and a mastic gasket material. Mounting style shall be as listed in the Slide Gate Schedule.

3. The structural portion of the frame that incorporates the seat/seals shall be formed into a one-piece shape for rigidity.
4. The frame shall extend to accommodate the entire height of the slide when the slide is in the fully closed or fully opened position. On self-contained gates, a stainless-steel yoke shall be provided across the top of the frame. The yoke shall be formed by two structural members affixed to the top of the side frame members to provide a one-piece rigid assembly. The yoke shall be designed to allow removal of the slide.
5. A rigid stainless steel invert member shall be provided across the bottom of the opening. The invert member shall be of the flushbottom type on upward opening gates.
6. A rigid stainless steel top seal member shall be provided across the top of the opening on gates designed to cover submerged openings.
7. Guide rails shall be of such length as to retain at least 1/2 of the vertical height of the slide when it is in the fully opened position.
8. Guide rails shall have an accurately formed groove running the full length to receive the slide tongue.

C. Slide

1. The slide and reinforcing stiffeners shall be constructed of stainless steel plate. All structural components shall have a minimum thickness of 1/4-inch. Gates to be reinforced by horizontal stiffeners weld to side vertical stiffeners.
2. The slide shall not deflect more than 1/360 of the span or 1/16 inch, whichever is smaller, under the maximum design head.
3. When the width of the gate opening multiplied by the maximum design head is 80 square feet or greater, the portion of the slide that engages the guide groove shall be of a "thick edge" design. The thick edge portion of the slide shall have a minimum thickness of 3 inches.
4. Reinforcing stiffeners shall be welded to the slide and mounted horizontally. Vertical stiffeners shall be welded on the horizontal stiffeners for additional reinforcement.
5. The stem connector shall be constructed of two angles or plates. The stem connector shall be welded to the slide. A minimum of two bolts shall connect the stem to the stem connector.

D. Seals

1. All gates shall be provided with a self-adjusting UHMWPE seal system to restrict leakage in accordance with the requirements listed in this specification.
2. All gates shall be equipped with UHMW polyethylene seat/seals to restrict leakage and to prevent metal to metal contact between the frame and slide.
3. The seat/seals shall extend to accommodate at least 1.5 times the height of the slide when the slide is in the fully closed or fully opened position.
4. All upward opening gates shall be provided with a resilient seal to seal the bottom portion of the gate. The seal shall be attached to the invert member or the bottom of the slide and it shall be held in place with stainless steel attachment hardware.
5. The seal system shall be durable and shall be designed to accommodate high velocities and frequent cycling without loosening or suffering damage.

6. All seals must be bolted or otherwise mechanically fastened to the frame or slide. Arrangement with seals that are force fit or held in place with adhesives are unacceptable.
7. The seals shall be mounted so as not to obstruct the water way opening.
8. The seal system shall have been factory tested to confirm negligible wear (less than 0.01") and proper sealing. The factory testing shall consist of an accelerated wear test comprised of a minimum of 25,000 open-close cycles using a well-agitated sand/water mixture to simulate fluidized grit.
9. The sealing system shall seal in any position of the slide and let the water flow only through the intended gate opening. The seals shall meet the specified leakage rate in both seating and unseating conditions as specified herein.

E. Stems, Stem Couplings, and Stem Guides

1. Stem, stem couplings, and stem guides shall be provided in accordance with AWWA C561.
2. Unless otherwise specified, gates shall have single rising stems.
3. A threaded operating stem shall be utilized to connect the operating mechanism to the slide. On rising stem gates, the threaded portion shall engage the operating lift nut in the manual operator. On non-rising stem gates, the threaded portion shall engage the thrust nut on the slide.
4. The stem shall have a minimum diameter of 1-1/2 inches.
5. The stem shall be constructed of solid stainless steel bar for the entire length, the metal having a tensile strength of not less than 75,000 psi for stems that are 3 inches or less in diameter. Stems that are in excess of 3 inches in diameter shall have a tensile strength of 75,000 psi.
6. The stem shall be threaded to allow full travel of the slide unless the travel distance is otherwise shown on the Drawings.
7. Maximum L/R ratio for the unsupported part of the stem shall not exceed 200.
8. In compression, the stem shall be designed for a critical buckling load caused by a 40 lb effort on the handwheel with a safety factor of 2 using the Euler column formula.
9. The stem shall be designed to withstand the tension load caused by the application of a 40 lb effort on the handwheel without exceeding 1/5 of the ultimate tensile strength of the stem material.
10. The threaded portion of the stem shall have machine cut or rolled threads of the full depth Acme type with a 16 microinch finish or better.
11. Stems of more than one section shall be joined by stainless steel couplings. The coupling shall be bolted to the stems.
12. Stems on manually operated gates shall be provided with adjustable stop collars to prevent over closing of the slide.
13. Stem guide shall be provided when necessary to ensure that the maximum L/R ratio for the unsupported part of the stem is 200 or less.
14. Stem guide brackets shall be fabricated of stainless steel and shall be outfitted with UHMW or bronze bushings.
15. Stem guides shall be adjustable in two directions.

F. Wall Thimbles

1. Wall thimbles shall be provided when shown on the Drawings.
2. The wall thimble depth shall be equal to the thickness of the concrete wall in which the thimble is to be mounted.
3. Wall thimbles shall be fabricated stainless steel construction, or pipe material when connecting to a pipe, of adequate section to withstand all operational and reasonable installation stresses.
4. Wall thimbles shall be constructed of 1/4-inch minimum thickness stainless steel and the front face shall have a minimum thickness of 1/4-inch.
5. The fabrication process shall ensure that the wall thimble is square and plumb and the front face is sufficient flat to provide a proper mounting surface for the gate frame.
6. The face of the wall thimble shall only be machined if recommended by the gate manufacturer. If the wall thimble is to be machined, the front face shall have a minimum thickness of 1/4-inch after machining.
7. A water stop shall be welded around the periphery of the thimble. Wall thimbles shall be designed to allow thorough and uniform concrete placement during installation.
8. Studs and nuts shall be stainless steel.
9. A suitable gasket or mastic shall be provided to seal between the gate frame and the wall thimble.
10. Wall thimbles shall be provided with all gates except those to be mounted on pipe flanges or those to be attached to concrete headwalls with anchor bolts, as shown on the Drawings.
11. There shall be an integral water stop around the periphery of the thimble.
12. The front flange of the thimble shall be machined, drilled, and tapped to receive the slide gate attaching studs. Thimble bolt pattern shall match gate bolt pattern.
13. The vertical centerline shall be shown by permanent marks at the top and bottom of the machined face with the word "top" marked near the top center of the thimble opening.

G. Wall Brackets

1. Fabricated stainless steel, mounted as shown in the Drawings.
2. Brackets shall be of sufficient size and strength to support the lift and adequately transmit to the structure the forces generated without sustaining damage to the structure, bracket, and gate assembly.
3. Brackets shall have slotted holes of proper adjustment to orient the lift and stem to the gate.

H. Flange Mount

1. Provide circular flange with 125 lb standard mounting for direct connection to pipe as shown on the Drawings.

I. Stem Covers

1. Operators shall be equipped with fracture-resistant clear butyrate or lexan plastic stem covers with condensation vent.

2. Provide with OPEN/CLOSED designators with 1-inch graduations on clear mylar pressure sensitive, adhesive tape, suitable for outdoor application.
3. The top of the stem cover shall be closed.
4. The bottom end of the stem cover shall be mounted in a housing or adapter for easy field mounting.

2.05 GATE OPERATORS

- A. Sealed, ball thrust, roller, or needle bearing type and equipped with bronze lift nut, internally threaded with Acme threads.
- B. The manual effort for any operator shall not exceed 40 foot-pounds.
- C. Type 1, Handwheel operated as shown on the Drawings
 1. Unless otherwise shown on the Drawings, gates shall be operated by a manual handwheel. The operator shall be mounted on the yoke of self contained gates or on the pedestal of non-self contained gates.
 2. The gate manufacturer shall select the proper gear ratio to ensure that the gate can be operated with no more than a 40 lb effort when the gate is in the closed position and experiencing the maximum operating head.
 3. An arrow with the word "OPEN" shall be permanently attached or cast onto the operator to indicate the direction or rotation to open the gate.
 4. Handwheel operators shall be fully enclosed.
 - a. Handwheel operators shall be provided with a threaded cast bronze lift nut to engage the operating stem.
 - b. Handwheel operators shall be equipped with roller bearings above and below the operating nut.
 - c. Positive mechanical seals shall be provided above and below the operating nut to exclude moisture and dirt and prevent leakage of lubricant out of the hoist.
 - d. The handwheel shall be removable and shall have a minimum diameter of 15 inches.
 5. An extended operator system utilizing chain and sprockets shall be furnished by the manufacturer when the centerline of the handwheel, on a non-gear operator, is located over 48-in above the operating floor. Chain wheels are not acceptable.
 - a. A removable stainless steel or aluminum cover shall be provided to enclose chain and sprockets.
 - b. The extended operator system shall lower the centerline of the pinion shaft to 36-in above the operating floor.
 - c. A handwheel may be utilized in conjunction with a gearbox in lieu of the extended operator system if the centerline of the pinion shaft is 60-in or less above the operating floor.
 6. Pedestals shall be constructed of stainless steel.
 - a. The pedestal height shall be such that the handwheel is located approximately 36-in above the operating floor.

- b. Wall brackets shall be used to support floor stands where shown on the Drawings and shall be constructed of stainless steel. Wall mounted pedestal designs shall also be acceptable.
- c. Wall brackets shall be reinforced to withstand in compression at least two times the rated output of the operator with a 40 lb effort on the handwheel.
- d. The design and detail of the brackets and anchor bolts shall be provided by the gate manufacturer and shall be approved by the Engineer. The gate manufacturer shall supply the bracket, anchor bolts and accessories as part of the gate assembly.

2.06 APPURTENANCES

- A. Lifting Lugs: For equipment assemblies and components weighing over 100 pounds.
- B. Anchor Bolts: Sized by equipment manufacturer, minimum diameter of 1/2-inch.

2.07 SPARE PARTS AND SPECIAL TOOLS

- A. The following spare parts shall be provided for the equipment specified in this Section. Spare parts shall be tagged and stored as specified in Section 11 00 00.
 - 1. 1 – limit nut for each size of gate stem
 - 2. 1 – bronze lift nut for each size of gate stem
 - 3. 1 – complete set of special tools required to maintain or dismantle

PART 3 EXECUTION

3.01 GENERAL

- A. Accurately place anchor bolts using templates furnished by the manufacturer.
- B. Lubricate before operating as per manufacturer's recommendations.
- C. The gate assemblies shall be installed in a true vertical plane, square and plumb.
- D. Field mount operators after installing gates.
- E. Brace thimbles internally during concrete placement.
- F. Fill the void in between the gate frame and the wall with non-shrink grout as shown on the installation drawing and in accordance with the manufacturer's recommendations.
- G. Add a mastic gasket between the gate frame and wall thimble in accordance with the manufacturer's recommendations.
- H. Gates to be installed on a 1 inch grout cushion in accordance with recommendations of the gate supplier.

3.02 INSTALLATION AND FIELD TESTING

- A. After completion of the installation and manufacturer's certification, the equipment shall be field tested to demonstrate compliance with the requirements specified. Installation, start-up and testing shall be conducted in accordance with Section 01 91 13 and Section 11 00 00.
- B. Each gate shall be cycled to confirm that they operate without binding, scraping, or distorting. The effort to open and close manual operators shall be measured, and shall not exceed the maximum operating effort specified above. Electric motor actuators shall function smoothly and without interruption. Each gate shall be water tested by the Contractor as specified herein to confirm that leakage does not exceed the specified allowable leakage.
- C. Functional Tests: Each gate for two complete open and close cycles.
- D. Performance (Leakage) Test for Each Gate
 - 1. Each gate.
 - 2. Under actual or Engineer-approved simulated operating conditions.
 - 3. For a continuous 3-hour time period without malfunction or surpassing leakage standards called for in specification.
 - 4. Adjust, realign, or modify units and retest if necessary.

3.03 FIELD SERVICE

- A. Provide the service of a qualified representative for a minimum of one (1) trip and one (1) day to advise and supervise installation of at least two (2) gates.
- B. Provide the service of a qualified representative for one (1) trip and one (1) day for installation inspection, performance testing, and start-up supervision/certification.

3.04 TRAINING

- A. Training shall be conducted in accordance with Section 01 79 00 and Section 11 00 00. Training shall consist of a minimum of two 2-hour sessions addressing the theory of operation, testing, troubleshooting, and maintenance of the equipment.

SLIDE GATE SCHEDULE

Tag	Size (W x H), inches	Nominal Gate Height, inches	Gate Material	Design Head from Invert of Gate		Open Channel Closure? (Y/N)	Actuator Type	Opening Direction	Mounting Type		Stem Type (Rising, Non- Rising)	P&ID	Drawing
				Seating, feet	Unseating, feet				Invert	Sides & Top			
SG 2101	24 x 24	24	304 SS	4.45	4.45	Y	MHW	Upward	FE	FE	R	P-2100	M-2100
SG 2102	24 x 24	24	304 SS	0.45	0.45	Y	MHW	Downward	FE	FE	R	P-2100	M-2100
SG 2201	24 x 24	24	304 SS	4.45	4.45	Y	MHW	Upward	FE	FE	R	P-2100	M-2100
SG 2202	24 X 24	24	304 SS	0.45	0.45	Y	MHW	Downward	FE	FE	R	P-2100	M-2100

Notes:

- MHW = manual hand wheel
- MotorHW = motorized hand wheel
- FOW = face of wall
- FE = frame embedded
- ON = operating nut
- NR = non-rising
- R = rising

END OF SECTION

SECTION 46 41 23
SUBMERSIBLE MIXERS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish, install and test submersible mixers for mixing mixed liquor including all ancillary items and equipment as shown in the Drawings and as specified herein to provide a fully functioning system.

1.02 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00 and Section 11 00 00. The following additional submittals shall be provided in accordance with Section 01 33 00:

1. Mixer mount system drawings.
2. Mixer hoist drawings.

1.03 REFERENCES

- A. This section contains references to the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ASTM A48/A48M-03	Standard Specification for Gray Iron Castings
ASTM A276-04	Standard Specification for Stainless Steel Bars and Shapes
ANSI/AGMA 2001	Load Ratings and Fatigue Lift for Ball Bearings
A304-02	Standard Specification for Carbon and Alloy Steel Bars Subject to End-Quench Hardenability Requirements
NEMA MG1-2003	Motors and Generators
ISS Type 304 Stainless Steel	Standard Wrought Steels Pocketbook, Relevant Section
ISS Type 316 Stainless Steel	Standard Wrought Steels Pocketbook, Relevant Section
ISS Type 420 Stainless Steel	Standard Wrought Steels Pocketbook, Relevant Section

1.04 QUALITY ASSURANCE

- A. Manufacturer's Experience: Manufacturer shall be one who has been regularly engaged in the business specified herein for at least 5 years. The equipment and all ancillary shall be designed, supplied and warranted as a unit item by a single manufacturer or vendor.
- B. Warranty: As specified in Section 11 00 00.

1.05 EQUIPMENT SCHEDULE

Item	Location	Equipment number
Submersible Mixer	Anaerobic Zone 1	MXR 2110
Submersible Mixer	Anaerobic Zone 1	MXR 2120
Submersible Mixer	Anaerobic Zone 2	MXR 2210
Submersible Mixer	Anaerobic Zone 2	MXR 2220

1.06 SERVICE CONDITIONS

- A. Fluid temperature is expected to range from 35 to 75 degrees Fahrenheit.
- B. The equipment will be installed outdoors at a wastewater treatment plant in Superior, Colorado at an elevation of approximately 5,300 feet above mean sea level.
- C. The equipment to be provided under this section shall be suitable for continuous (24 hour per day) outdoor operation submerged in mixed liquor in sludge, anaerobic, anoxic, and swing zone basins at a wastewater treatment plant. The pH of the sewage may vary from 5.0 to 9.0. The suspended solids concentration may vary from 800 to 8,000 milligrams per liter.

PART 2 PRODUCTS

2.01 ACCEPTABLE PRODUCTS

- A. Acceptable manufacturers include:
 - 1. Flygt
 - 2. Wilo
 - 3. Sulzer
 - 4. Engineer approved equal.

2.02 GENERAL

- A. Each mixer shall be of the close-coupled submersible type. All components of the mixer, including the motor, shall be capable of continuous underwater operation without loss of watertight integrity to a depth of 30 feet.
- B. The submersible mixers shall be close-coupled and be capable of traveling up and down on a vertical guide rail with provision for easy alteration of the operating angle.
- C. Each mixer shall include a optional jet ring, power and control cable, three (3) power cable holders, and a mounting assembly of consisting of a single guide bar system, 30 feet minimum of ¼ inch mixer support cable, and a 20-foot long stainless steel 4" x 4" mast tube or 2"x 2" SS mast tube with intermediate support.
- D. All mating surfaces where watertight sealing is required shall be machined and fitted with O rings. Fitting shall be such that sealing is accomplished by metal to metal contact between machined surfaces.
- E. Each mixer shall be provided with two sets of lapped end face type mechanical seals for the propeller shaft running in oil reservoirs for cooling and lubrication. The mechanical seals shall

contain positively driven rotary, corrosion resistant face rings. Only the seal faces of the outer seal assembly shall be exposed to the mixed media, with all other components contained in the oil housing. Seals shall require neither maintenance nor adjustment and shall be easy to check and replace. Shaft seals without positively driven rotating members shall not be considered acceptable. Shaft seals shall conform to the requirements of specification 11 00 00.

- F. Each mixer's oil housing shall contain two (2) oil chambers for the shaft sealing system. The drain and inspection plugs, with positive anti-leak seal, shall be easily accessible from the outside.
- G. The mixers shall be capable of being raised out of the liquid for maintenance or repair without dewatering any basins.

2.03 DESIGN AND PERFORMANCE REQUIREMENTS

- A. The mixer with the motor shall be suitable for operation submersed in sewage and designed for continuous duty under the specified design conditions. The mixer shall provide thorough mixing of the screened wastewater with the return activated sludge. The mixers shall be operated without diffused aeration and keep the mixed liquor sufficiently agitated to keep the solids (8,000 mg/l maximum suspended solids) in suspension.

B. Performance Requirements

Criteria	Value	
	Anaerobic Zone 1	Anaerobic Zone 2
Location		
Equipment No.	MXR 2110 MXR 2120	MXR 2210 MXR 2220
Zone dimensions, W x L x D, feet	40 x 20 x 12	40 x 20 x 12
Average Flow per basin, gpm	1,200 gpm	1,200 gpm
Propeller maximum speed, rpm	900	900
Max hp (Total per Zone)	6	6
Motor Inverter Service	No	No

2.04 MATERIALS OF CONSTRUCTION

Component	Material
Inner Stator Base	Cast Iron
Outer Stator Jacket	316 Stainless Steel
Slide Bracket, Cable Entry, Mixer Top	316 Stainless Steel
Propeller	316 Stainless Steel
Propeller Shaft	316 Stainless Steel
O-rings and Cable Entry Grommets	Fluorinated rubber
Inner and Outer Mechanical Seals	Tungsten Carbide
Oil Housing Cover Plate	FRP Vinylester or 316 SS
Jet Ring	304 Stainless Steel
Screws, Nuts, Washers, Fasteners, and Anchor Bolts	304 Stainless Steel

Component	Material
Mounting Mast	316 Stainless Steel
Mounting Mast Guide Brackets	316 Stainless Steel
Support Cable	316 Stainless Steel

- A. All welds must utilize filler to insure that all welds are as least as thick as the parent material.
- B. Mixer components of cast iron shall have smooth surfaces devoid of blowholes and other irregularities. All surfaces coming into contact with sewage or construction materials other than stainless steel shall, be protected by a zinc phosphate primer and an epoxy finish coat.

2.05 EQUIPMENT FEATURES

A. Motor

1. Motor shall be a NEMA type B squirrel-cage induction shell type design housed in an air filled watertight chamber rated for operation at 460 volts, 3 phase, 60 Hz. Where specified, motors intended for use with variable frequency controllers shall specifically designed for inverter service for the speed range and load torque characteristic required by the associated driven equipment. Motors shall be designed to operate over the speed or frequency range specified. Motors shall conform to the requirements of specification 11 05 13.
2. Motor insulation shall be Class H trickle impregnated designed to meet NEMA MG 1, Part 31 (1600 volt peak at a minimum of 0.1 microsecond rise time). The motor shall be designed for continuous duty. The temperature rise of the motor shall not be in excess of that specified in NEMA Standard MG-1 for Class B insulating materials when operating continuously under load
3. The combined service factor (combined effect of voltage, frequency, specific gravity, etc.) shall be 1.10. The motor shall have a voltage tolerance of plus or minus 10% and a frequency tolerance of plus 5%. The motor shall be rated for operation in a 40 degree C ambient temperature.
4. The cable entry shall be an integral part of the stator casing. The cable entry shall be comprised of a single or double set of cylindrical elastomer grommets, flanked by washers and a ferrule designed with close tolerance fit against the cable outside diameter and the entry inside diameter. This shall provide a leakproof seal at the cable entrance without the need for specific torque requirements.
5. The junction chamber and motor compartment shall be separated by a terminal board which shall protect the motor interior from foreign material gaining access into the mixer top. Connection between the cable conductors and stator leads shall be made with threaded compressed type binding posts permanently affixed to the terminal board and thus perfectly leak-proof. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.
6. The submersible electrical cable shall be type SPC and be of sufficient length to reach the termination point indicated on the Drawings plus five feet. The cable shall also include two control conductors for interfacing to the motor overtemperature and moisture sensors. The material shall be rated for submersible wastewater service.
7. The maximum motor horsepower shall be as specified in paragraph 46 41 23-2.3. The actual horsepower shall be adequate throughout the range of the published curve without overloading.
8. The motor shall be provided with overtemperature and moisture protection. Overtemperature protection shall monitor the stator winding temperature. Moisture

protection shall detect the presence of water in the stator and seal oil housing. Both protection systems shall internally connected in series and shall interface to a supervisory relay via two common wires. The supervisory relay shall have two Form C contacts for independent indication of overtemperature and leakage.

9. Contacts shall be rated 8 amperes, 250 volt AC. The supervisory relay shall have a Manual/Auto reset selector switch and in the manual reset mode shall be reset via an external contact closure. Supervisory relay shall operate at 24 volts AC and shall be furnished with a mounting socket suitable for back panel mounting. Supervisory relay shall be shipped loose for installation in the associated motor control center.

B. Propeller

1. The propeller shall be dynamically balanced and of a single non-clogging backward curved design. The propeller shall be capable of handling solids, fibrous materials, heavy sludge, and other matter found in normal sewage applications. The propeller shall be of a three-vane design.
2. The jet ring mounting shall maintain a maximum clearance of 1.5 inches between the propeller tip and the inside of the shroud.

C. Bearings

1. All bearings shall have a minimum B-10 rated life of 100,000 hours. The bearing races shall be of metallic construction, and bearing races made from nonmetallic construction shall not be considered acceptable. The outboard propeller bearings shall be an angular contact bearing. All bearings shall be pre-loaded.

D. Mounting Assembly

1. A mounting assembly shall support each mixer during operation and guide the unit during installation or removal. Each assembly shall consist of three (3) guide brackets, a guiding mast, and a suitable length of support cable. Each system shall be constructed as a safe-slide system, providing an overall system height as indicated on the Drawings.
2. A manual hoist shall be furnished to assist in installation, removal, or adjustment of any of the mixers. The hoist shall be of stainless steel construction and shall include a winch.
3. One (1) stainless steel lifting cable shall be attached to each mixer that will be attached to the cable on the hoist winch spool when the mixer requires lifting. Each assembly shall be capable of lifting the heaviest mixer provided in this section.
4. One (1) wall socket assembly shall be provided for each mixer. The Contractor shall coordinate with the Engineer, mixer manufacturer, hoist supplier, and any adjacent hand railing, grating, or checker plate installation to ensure the socket is located correctly. The socket shall be located so as to allow for easy hoist removal around the hand railing. The socket shall be located the same distance from each mixer so the hoist can be used interchangeably at each mixer without setting adjustment.

2.06 SPARE PARTS

- A. Spare parts as recommended by the manufacturer for routine maintenance shall be provided. Spare parts shall be tagged and stored as specified in Section 11 00 00.

PART 3 EXECUTION

3.01 GENERAL

- A. Installation, start-up and testing shall be conducted in accordance with Section 01 91 13 and Section 11 00 00.
- B. Contractor shall confirm with manufacturer the optimal vertical mounting elevation of each mixer within each zone.

3.02 TESTING

- A. After completion of the installation and manufacturer's certification, equipment shall be field tested to demonstrate compliance with the requirements specified. Testing of equipment shall be conducted in accordance with the requirements of Sections 01 91 13 and 11 00 00.

3.03 FIELD SERVICE

- A. Provide the service of a qualified representative for one (1) trip and one (1) day to inspect the mechanism installation, assist in start up, and instruct plant personnel in the operation and maintenance of the mechanism.

3.04 TRAINING

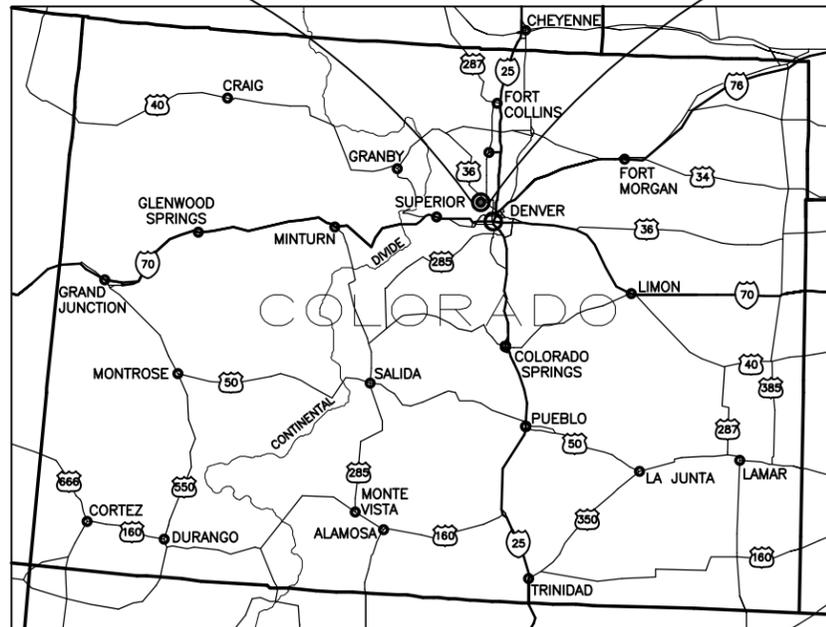
- A. Training shall be conducted in accordance with Section 01 79 00 and Section 11 00 00. Training shall consist of a minimum of one 2-hour session addressing the theory of operation, testing, troubleshooting, and maintenance of the equipment.

END OF SECTION

SUPERIOR METROPOLITAN DISTRICT NO. 1 ROCK CREEK WASTEWATER TREATMENT FACILITY 2125 HONEY CREEK LANE, SUPERIOR, CO. 80027 AERATION BASINS ANEROBIC ZONE EXPANSION

GENERAL NOTES

1. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THESE CONTRACT DOCUMENTS, TOWN OF SUPERIOR DESIGN STANDARDS AND SPECIFICATIONS, AND BE SUBJECT TO CONSTRUCTION OBSERVATION BY SUPERIOR METROPOLITAN DISTRICT REPRESENTATIVES OR PERSONNEL.
2. THE CONTRACTOR IS RESPONSIBLE FOR THE PROCUREMENT OF ALL PERMITS NECESSARY FOR THE CONSTRUCTION OF THE IMPROVEMENTS SHOWN AND FOR NOTIFYING ALL UTILITY COMPANIES AFFECTED BY THIS CONSTRUCTION.
3. THE CONTRACTOR SHALL VERIFY ELEVATIONS OF EXISTING PIPING AND OTHER UTILITIES AND STRUCTURES PRIOR TO CONSTRUCTION.
4. THE CONTRACTOR SHALL PROTECT ALL EXISTING STRUCTURES, EQUIPMENT AND PIPING.
5. ALL EXISTING PROCESS MECHANICAL AND ELECTRICAL EQUIPMENT THAT IS TO REMAIN OR BE SALVAGED FOR REUSE SHALL BE PROTECTED FROM DAMAGE FROM CONSTRUCTION ACTIVITIES AND WEATHER. ALL EQUIPMENT DAMAGED BY CONSTRUCTION OR WEATHER SHALL BE REPLACED WITH EQUAL OR BETTER AT CONTRACTORS EXPENSE.
6. THIS PROJECT WILL REQUIRE CONNECTION OF NEW PIPING AND EQUIPMENT TO EXISTING PIPING SYSTEMS, AND THE MODIFICATION OF EXISTING PIPING. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR VERIFYING THE QUALITY AND CONDITION OF THE EXISTING PIPING, EQUIPMENT AND RELATED APPURTENANCES USED IN THIS PROJECT. THE ENGINEER MAKES NO REPRESENTATION AS TO THE QUALITY, CONDITION OR SUITABILITY OF EXISTING PIPING, PIPE FITTINGS, APPURTENANCES, SUPPORTS OR OTHER RELATED FACILITIES OR EQUIPMENT IN THE EXISTING BUILDING THAT MAY BE UTILIZED IN THIS PROJECT. THE CONTRACTOR SHALL BRING ANY CONCERNS ABOUT THE CONDITION OF EXISTING PIPING, EQUIPMENT, AND RELATED APPURTENANCES IMMEDIATELY TO THE ATTENTION OF THE OWNER AND THE ENGINEER.
7. COORDINATE SEQUENCE OF DEMOLITION AND PIPING CONNECTIONS WITH JIM WIDNER, TOWN OF SUPERIOR, 303-381-2013.
8. THE CONTRACTOR SHALL MAINTAIN ON THE PROJECT SITE A FULL SET OF CONSTRUCTION DRAWINGS, RECORDING ALL INFORMATION PERTAINING TO THE CONSTRUCTION OF THESE FACILITIES. THESE RECORD DRAWINGS SHALL BE PROVIDED TO DEWBERRY ENGINEERS UPON PROJECT COMPLETION.
9. A PRE-CONSTRUCTION MEETING WILL BE HELD AT LEAST 48 HOURS PRIOR TO THE START OF CONSTRUCTION.
10. WORK HOURS SHALL BE BETWEEN 7AM AND 5PM MONDAY THROUGH FRIDAY, UNLESS OTHERWISE DIRECTED BY THE TOWN OF SUPERIOR.
11. NEW PIPE, FITTINGS, VALVES AND PIPE SUPPORTS SHALL BE PAINTED, PAINT SHALL BE TNE MEC SERIES 69N OR SHERWIN WILLIAMS MACROPOXY 646 B-58-699. FOR COATING SUPPLIER/COLOR SEE SPECIFICATION SECTION 09 90 00

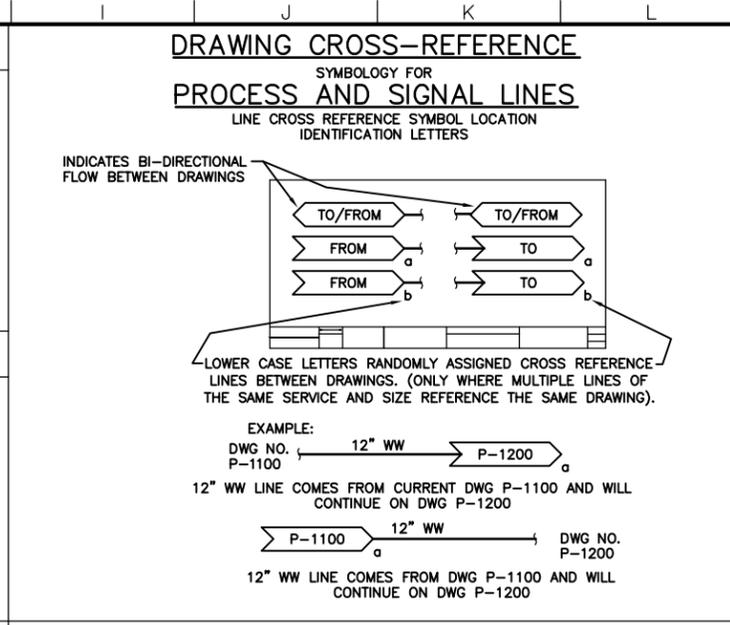
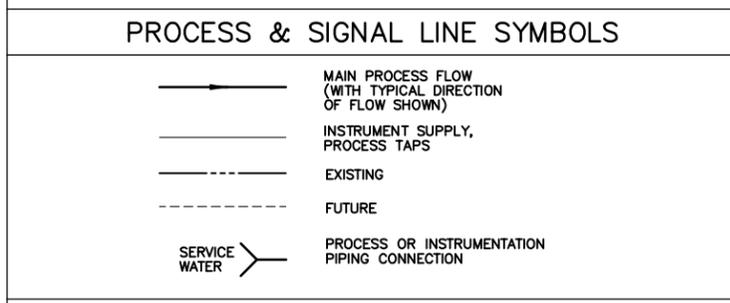
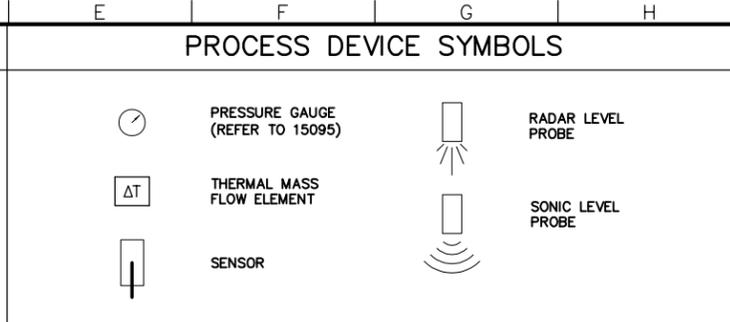
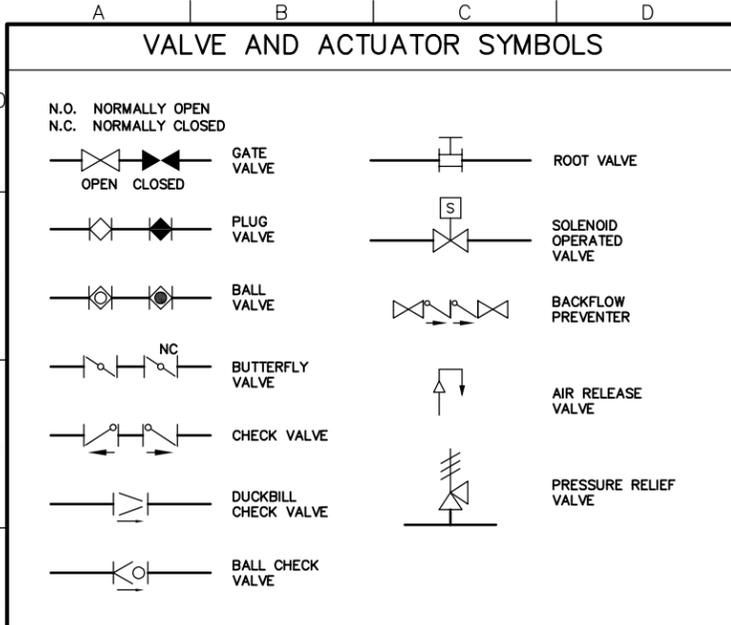


VICINITY AND LOCATION MAPS

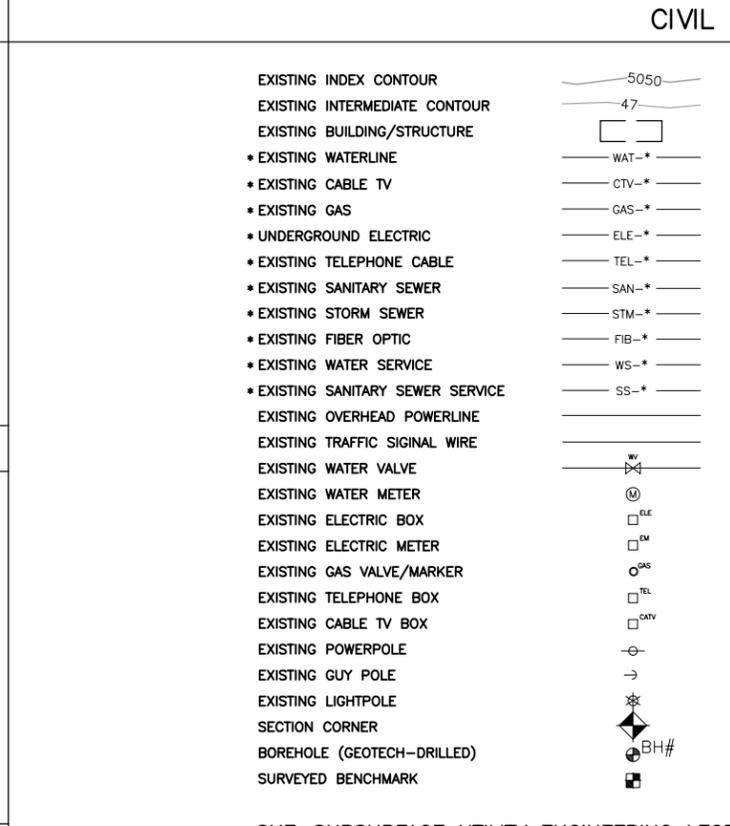
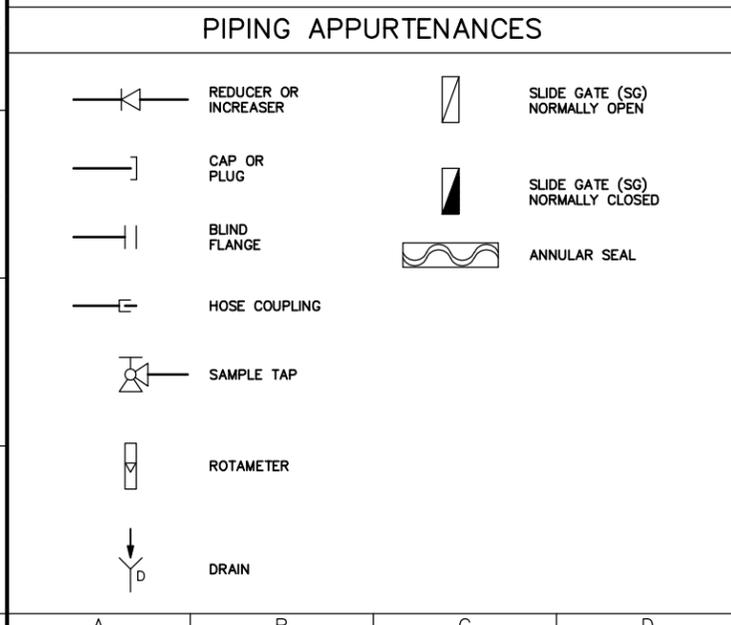
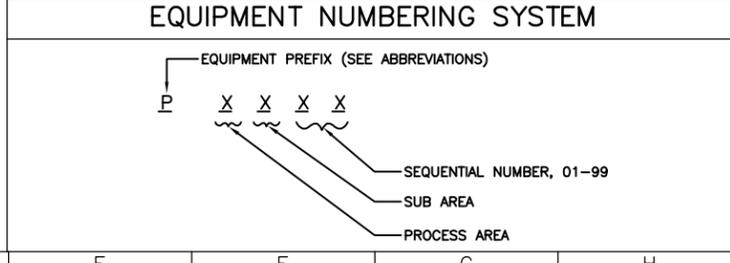
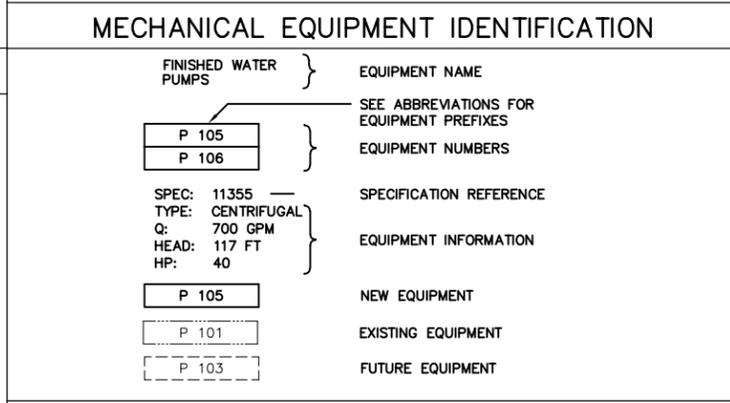
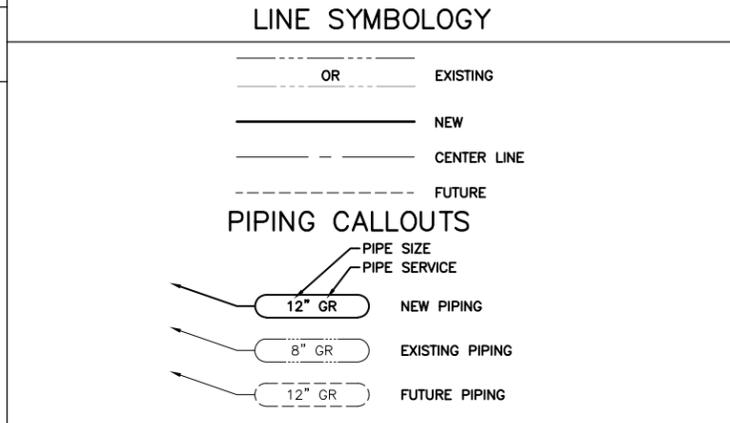
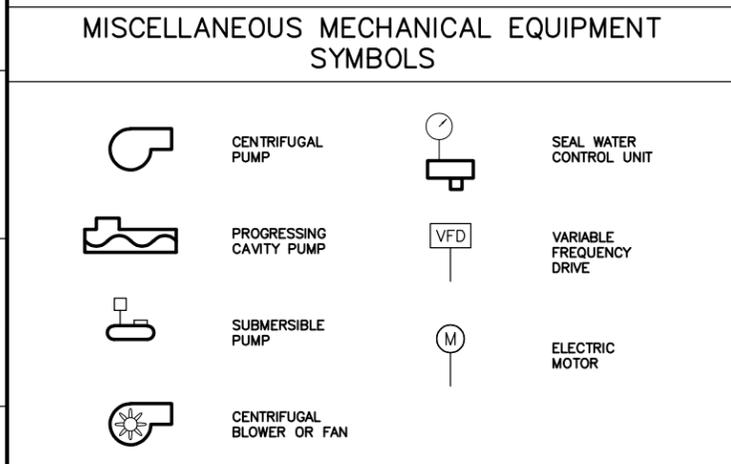
LIST OF DRAWINGS

DWG. NO.	TITLE
--	COVER SHEET
G-1	SYMBOLS AND LEGEND
G-2	ABBREVIATIONS, GENERAL NOTES AND INSTRUMENTATION LEGENDS
G-4	HYDRAULIC PROFILE
C-1	OVERALL SITE PLAN
C-2	ENLARGED SITE PLAN
C-3	ENLARGED GRADING PLAN
P-2100	ANAEROBIC ZONE TRAINS 1 AND 2
S-1	STANDARD DETAILS
S-2	STANDARD DETAILS
S-3	STANDARD DETAILS
S-4	STANDARD DETAILS
S-5	STANDARD DETAILS
S-2100	ANAEROBIC ZONE TRAINS 1 AND 2 PLAN
S-2101	ANAEROBIC ZONE TRAINS 1 AND 2 SECTION
S-2102	ANAEROBIC ZONE TRAINS 1 AND 2 SECTION
S-2103	ANAEROBIC ZONE TRAINS 1 AND 2 SECTION
M-1	STANDARD DETAILS
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M-1100	EXISTING SECONDARY TREATMENT COMPLEX DEMOLITION PLANS
M-1101	EXISTING SECONDARY TREATMENT COMPLEX DEMOLITION SECTIONS
M-1102	EXISTING SECONDARY TREATMENT COMPLEX LOWER LEVEL PLAN
M-1103	EXISTING SECONDARY TREATMENT COMPLEX GROUND LEVEL PLAN
M-1104	EXISTING SECONDARY TREATMENT COMPLEX SECTIONS
M-2100	ANAEROBIC ZONE TRAINS 1 AND 2 PLAN
M-2101	ANAEROBIC ZONE TRAINS 1 AND 2 SECTION
M-2102	ANAEROBIC ZONE TRAINS 1 AND 2 SECTIONS
M-2103	ANAEROBIC ZONE TRAINS 1 AND 2 SECTION
E-01	LEGEND AND ABBREVIATIONS
E-02	ONE-LINE DIAGRAM
E-03	SCHEMATIC
E-04	ENLARGED SITE PLAN
E-05	ELECTRICAL ROOM PLAN
E-06	ELECTRICAL DETAILS
E-07	ELECTRICAL DETAILS

**ISSUED FOR BID
DRAWINGS
SEPTEMBER 2024**



- ### P&ID GENERAL NOTES:
- PROCESS AND INSTRUMENTATION DIAGRAMS (PIDs) ARE PROCESS FLOW GUIDES. THEY DO NOT NECESSARILY REFLECT THE ACTUAL SPACE RELATIONSHIP OR ORIENTATION OF SOME ITEMS. PIDs ARE NOT TO BE INTERPRETED AS PLUMBING SCHEMATICS.
 - *V INDICATES VENDOR SUPPLIED PACKAGE.
 - *P INDICATES PRE-PURCHASED PACKAGE.
 - REFER TO EQUIPMENT SPECIFICATION SECTION AND PROCESS CONTROL STRATEGIES FOR EQUIPMENT CONTROL STRATEGY.
 - SYMBOLS ARE FOR REFERENCE ONLY. NOT ALL SYMBOLS SHOWN ARE USED IN THE CONTRACT.
 - FOR CONSTRUCTION "FURNISH" SHALL BE DEFINED AS, PURCHASED & PLACED BY CONTRACTOR, "PROVIDE" AS, CONTRACTOR SHALL PURCHASE & TURN OVER TO OWNER AND "INSTALL" AS, EQUIPMENT OR MATERIAL PROVIDED BY OTHER & PLACED BY CONTRACTOR.
 - FOR HVAC SYMBOLS, SEE HVAC DRAWINGS, FOR ELECTRICAL SYMBOLS, SEE ELECTRICAL DRAWINGS.
 - ALL MATERIALS, WORKMANSHIP, AND CONSTRUCTION OF PUBLIC IMPROVEMENTS SHALL MEET OR EXCEED THE STANDARDS AND SPECIFICATIONS SET FORTH IN THE APPLICABLE LOCAL REGULATIONS AND APPLICABLE STATE AND FEDERAL REGULATIONS. WHERE THERE IS CONFLICT BETWEEN THESE PLANS AND THE SPECIFICATIONS OR ANY APPLICABLE STANDARDS, THE HIGHER QUALITY STANDARD SHALL APPLY.
 - PLANT AREA OR PROCESS UNIT PREFIX MAY BE OMITTED FROM DRAWINGS AND COVERED BY NOTE WHEN ALL INSTRUMENTS ON DRAWINGS HAVE SAME PREFIX.



SUE-SUBSURFACE UTILITY ENGINEERING LEGEND NOTE:

*SUE QUALITY LEVEL LOCATES OF EXISTING UTILITIES ARE DEPICTED WITH A SUFFIX ON EXISTING UTILITY LINETYPES FROM B TO D DEPICTING THE ACCURACY, "QUALITY LEVEL" OF THE EXISTING UTILITY SHOWN ON THE DRAWINGS. (EXAMPLE WAT-B OR STM-C)

- QUALITY LEVEL A (PRECISE HORIZONTAL & VERTICAL LOCATION OF UTILITIES OBTAINED BY THE ACTUAL EXPOSURE OR POTHOLES)
- QUALITY LEVEL B (INFORMATION FROM ABOVE GROUND, HORIZONTAL SURVEY AND UTILITY LOCATES)
- QUALITY LEVEL C (ABOVE GROUND SURVEY & PROFESSIONAL JUDGEMENT TO LOCATE UTILITIES)
- QUALITY LEVEL D (RECORDS RESEARCH/DATA COLLECTION)

NOTE:
FOR CIVIL ABBREVIATIONS SEE STANDARD ABBREVIATIONS LIST ON DRAWING G-2.

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"=SCALE ACCORDINGLY)

DRAWING GDG61727-001
DRAWN STD
DESIGNED STD
CHECKED MDS

APPROVED:

PRINCIPAL

DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	PDR
B	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

GENERAL

SYMBOLS & ABBREVIATIONS

DATE: 07/07/24

PROJECT NUMBER: 50161727

REVISION NO. B

DRAWING NUMBER G-1

STANDARD ABBREVIATIONS

MECHANICAL ABBREVIATIONS:

1W	POTABLE WATER
2W	NON-POTABLE WATER (BACKFLOW PROTECTED POTABLE)
3W	NON-POTABLE WATER (RE-USE)
A	AIR
ALS	ALUM SOLUTION
ARV	AIR RELEASE VALVE
ATM	ATMOSPHERE
AWT	ADVANCED WASTEWATER TREATMENT
B	BLOWER
BF	BLIND FLANGE
BFP	BACKFLOW PREVENTER
BFV	BUTTERFLY VALVE
BWS	BACKWASH SUPPLY
BWW	BACKWASH WASTE
C	CENTERLINE
CA	COMPRESSED AIR
CAV	COMBINATION AIR VALVE
CEN	CENTRATE/CENTRIFUGE
CI	CAST IRON
CO	CLEANOUT
COL	COLLECTOR
CON	CONVEYOR
CP	COMPRESSOR
CV	CONTROL VALVE
Ø	DIAMETER
D, DRN	DRAIN
DG	DIGESTER GAS
DIP	DUCTILE IRON PIPE
DISCH	DISCHARGE
DRUM	DRUMATE
DS	DIGESTED SLUDGE
DWP	DEWATERING PUMP
DWAS	DILUTE WASTE ACTIVATED SLUDGE
DWS	DEWATERED SLUDGE
ED	EQUIPMENT DRAIN
EE	ENGINE EXHAUST
EQUIP	EQUIPMENT
EL	ELEVATION
FA	FOUL AIR
FAD	FOUL AIR DUCT
FC	FLUSHING CONNECTION
FCA	FLANGED COUPLING ADAPTER
FCO	FLOOR CLEANOUT
FE	FINAL EFFLUENT
FES	FLARED END SECTION
FLG	FLANGE
FLT	FILTER, FILTRATE
FM	FLOW METER, FORCE MAIN
FW	FILTERED WATER
FOG	FATS OIL AND GREASE
GC	GRIT COLLECTOR
GLR	GLYCOL RETURN
GLS	GLYCOL SUPPLY
GLY	GLYCOL
GPM	GALLONS PER MINUTE
GR	GRIT
HB	HOSE BIBB
HP	HORSEPOWER
HW	HOT WATER (POTABLE)
HWR	HOT WATER RETURN
IE	INVERT ELEVATION
INV	INVERT
M	MOTOR
MECH	MECHANICAL, MECHANISM
MH	MANHOLE
MJ	MECHANICAL JOINT
ML	MIXED LIQUOR
MLR	MILWAUKEE WATERWORKS STANDARDIZATION SOCIETY
MME	MISCELLANEOUS MECHANICAL EQUIPMENT
MSS	MIXER
MXR	MIXER
NC	NORMALLY CLOSED
NG	NATURAL GAS
NO	NORMALLY OPEN
NPT	NATIONAL PIPE THREAD
NPW	NON-POTABLE WATER
OD	OUTSIDE DIAMETER
OF	OVERFLOW
OSA	OUTSIDE AIR
P	PUMP
PB	PRIMARY BYPASS
PD	PUMPED DRAIN
PE	PRIMARY EFFLUENT, PLAIN END
PI	PRIMARY INFLUENT, PRESSURE INDICATOR
PNL	PANEL
POL	POLYMER
PRV	PRESSURE REDUCING VALVE
PS	PRIMARY SLUDGE, PRIMARY SOLIDS
PSC	PRIMARY SCUM
PSI	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE PIPE
RAS	RETURN ACTIVATED SLUDGE
RCP	REINFORCED CONCRETE PIPE
RD	ROOF DRAIN
RDT	ROTARY DRUM THICKENER
RG	REFRIGERANT GAS
RL	REFRIGERANT LIQUID

RAW SEWAGE

RWP	RAIN WATER PIPE
SCR	SCREEN
SCS	SUPPLEMENTAL CARBON SOLUTION
SD	SANITARY DRAIN
SE	SECONDARY EFFLUENT
SEP	SEPTAGE
SG	SLUDGE GATE
SHC	SODIUM HYPOCHLORITE
SIL	SILENCER
SLG	SLUDGE GATE
SMP	SAMPLER
SNT	SUPERNATANT
SR	SLUDGE RECIRCULATION
SRW	SOLIDS RESIDUALS WASTE
SS	SANITARY SEWER
SSC	SECONDARY SCUM
STM	STORM DRAIN
SV	SOLENOID VALVE
SWU	SEAL WATER UNIT
SUCT	SUCTION
T	TANK
TA	TREATED AIR
TD	TANK DRAIN
TDS	THICKENED DIGESTED SLUDGE
THD	THREADED
THS	THICKENED SLUDGE
TWAS	THICKENED WASTE ACTIVATED SLUDGE
UH	UNIT HEATER
V	VENT
VTR	VENT THROUGH ROOF
W	WATER
WAS	WASTE ACTIVATED SLUDGE
WH	WATER HEATER
WS	WATER SURFACE
WW	WASTEWATER
YCO	YARD CLEANOUT

GENERAL ABBREVIATIONS:

DET	DETAIL
EOR	EDGE OF ROAD
FEET	FEET
GRC	GALVANIZED RIGID CONDUIT
HBP	HOT BITUMINOUS PAVEMENT
MCM	1000 CIRCULAR MILS
NTS	NOT TO SCALE
SQ FT	SQUARE FEET
TYP	TYPICAL
OC	ON CENTER
PLATE	PLATE
PSF	PER SQUARE FOOT
PT	PRESSURE TREATED
REINF	REINFORCING
REQD	REQUIRED
RIS	RISER
SCHD	SCHEDULE
SS	STAINLESS STEEL
SSFH	STAINLESS STEEL FLAT HEAD
STD	STANDARD
STRUCT	STRUCTURAL
T&B	TOP & BOTTOM
THD	THREADED
T, THK	THICK, THICKNESS
TOP	TOP OF
TOC	TOP OF CONCRETE
TOG	TOP OF GRATING
TOW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W/	WITH
WPJ	WEAKENED PLANE JOINT
WWF	WOVEN WIRE FABRIC

ABBREVIATION NOTES:

- ABBREVIATIONS ARE FOR REFERENCE ONLY, NOT ALL ABBREVIATIONS ARE USED IN THIS CONTRACT.
- FOR ELECTRICAL ABBREVIATIONS SEE DRAWING E-1, FOR HVAC ABBREVIATIONS SEE DRAWING H-1.

STRUCTURAL ABBREVIATIONS:

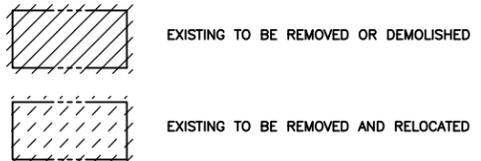
∅	AT
/	ANGLE
AB	ANCHOR BOLT
ACI	AMERICAN CONCRETE INSTITUTE
AFF	ABOVE FINISHED FLOOR
ALT	ALTERNATE
ALUM	ALUMINUM
ANCH	ANCHOR
BM	BEAM
BO	BOTTOM OF
BOT	BOTTOM
CL	CENTER LINE
CLR	CLEAR
CONST	CONSTRUCTION
CONT	CONTINUOUS
CTR	CENTER
CTRD	CENTERED
DBL	DOUBLE
DEG	DEGREE
DIA	DIAMETER
DIM	DIMENSION
DWG	DRAWING
EA	EACH
EF	EACH FACE
EW	EACH WAY
EXP	EXPANSION
FAB	FABRICATE
FDN	FOUNDATION
FF	FINISHED FLOOR
FRP	FIBER REINFORCED PLASTIC
FTG	FOOTING
GALV	GALVANIZED
GRTG	GRATING
HORIZ	HORIZONTAL
HP	HIGH POINT
JT	JOINT
LIN	LINEAR, LINEAL
MATL	MATERIAL
MAX	MAXIMUM
MIN	MINIMUM
NAAMM	NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS
OC	ON CENTER
PLATE	PLATE
PSF	PER SQUARE FOOT
PT	PRESSURE TREATED
REINF	REINFORCING
REQD	REQUIRED
RIS	RISER
SCHD	SCHEDULE
SS	STAINLESS STEEL
SSFH	STAINLESS STEEL FLAT HEAD
STD	STANDARD
STRUCT	STRUCTURAL
T&B	TOP & BOTTOM
THD	THREADED
T, THK	THICK, THICKNESS
TOP	TOP OF
TOC	TOP OF CONCRETE
TOG	TOP OF GRATING
TOW	TOP OF WALL
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W/	WITH
WPJ	WEAKENED PLANE JOINT
WWF	WOVEN WIRE FABRIC

INSTRUMENT IDENTIFICATION TABLE

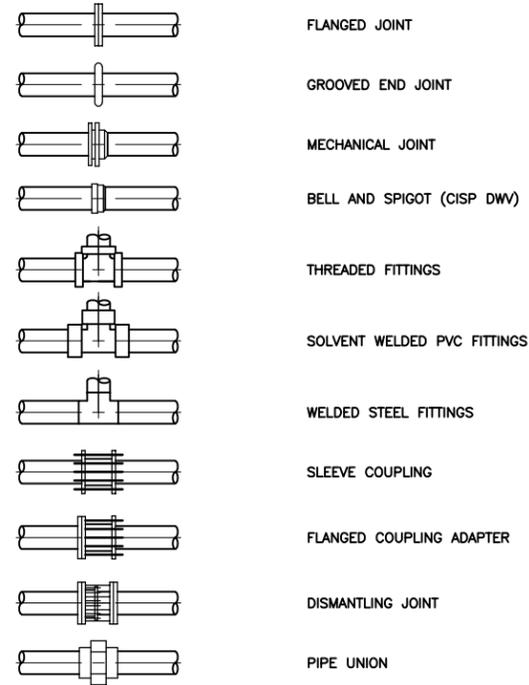
FIRST LETTER			SUCCEEDING- LETTERS		
LETTER	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (2)	-----	ALARM	INCREASE, SLOW, FORWARD	-----
B	BURNER, COMBUSTION	-----	-----	STOP, DECREASE (1)	-----
C	CONDUCTIVITY	-----	-----	CONTROL, CLOSE	-----
D	DENSITY	DIFFERENTIAL	SENSOR (PRIMARY ELEMENT)	-----	START, INCREASE
E	VOLTAGE (EMF)	-----	-----	-----	-----
F	FLOW, FLOW RATE	RATIO (FRACTION)	GLASS, VIEWING DEVICE	-----	FAIL (1)
G	GAUGING (DIMENSIONAL)	-----	INDICATE	-----	HIGH (OPENED)
H	HAND	-----	-----	-----	-----
I	CURRENT (ELECTRICAL)	-----	-----	CONTROL STATION	-----
J	POWER	SCAN	-----	-----	-----
K	TIME OR TIME-SCHEDULE	TIME RATE OF CHANGE	-----	-----	-----
L	LEVEL	-----	LIGHT	-----	LOW
M	MOTOR, MOTION, MOISTURE	MOMENTARY	-----	MOTOR (1)	MIDDLE, INTERMEDIATE
N	ELECTRIC/SOLENOID OPER.	-----	-----	OPEN	ON OR OPERATE (1)
O	-----	-----	ORIFICE, RESTRICTION POINT (TEST) CONDITION	-----	OVERLOAD
P	PRESSURE OR VACUUM	-----	RECORD	-----	-----
Q	QUANTITY (2)	INTEGRATE, TOTALIZE	-----	-----	-----
R	RADIATION	-----	-----	-----	-----
S	SPEED OR FREQUENCY	SAFETY	-----	SWITCH	-----
T	TEMPERATURE	-----	-----	TRANSMIT	-----
U	MULTIVARIABLE (2)	-----	MULTIFUNCTION (2)	MULTIFUNCTION (2)	MULTIFUNCTION (2)
V	VIBRATION	-----	-----	VALVE, DAMPER, LOUVER	-----
W	WEIGHT OR FORCE, TORQUE	-----	WELL	-----	-----
X	UNCLASSIFIED (2)	-----	UNCLASSIFIED (2)	UNCLASSIFIED (2)	UNCLASSIFIED (2)
Y	EVENT, STATE OR PRESENCE	-----	-----	RELAY, COMPUTATE, CONVERT	-----
Z	POSITION, DIMENSION	-----	-----	DRIVER, ACTUATOR, OR CONTROL ELEMENT	-----

(1) USERS CHOICE
(2) WHEN USED, SIGNAL OR SIGNAL LINE ANNOTATED

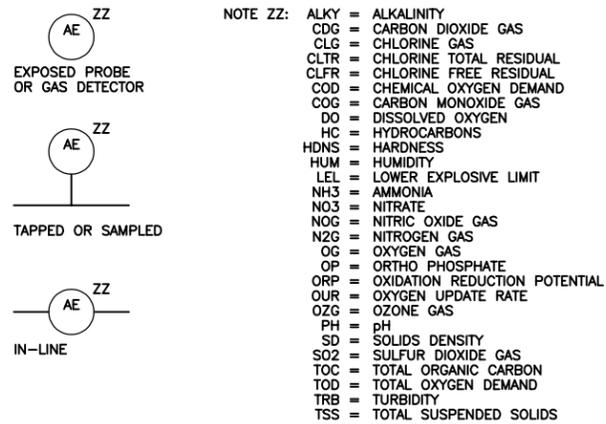
DEMOLITION AND RELOCATION SYMBOLS



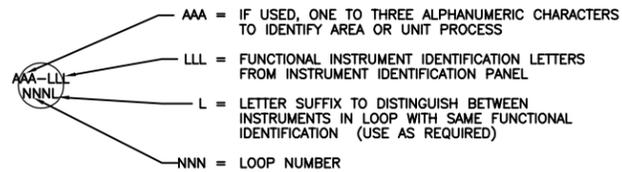
PIPE CONNECTION SYMBOLOGY



ANALYSIS INSTRUMENTS



INSTRUMENT & FUNCTION TAGGING



LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"=SCALE ACCORDINGLY)

DRAWING_GDG61727-002

DRAWN STD

DESIGNED STD

CHECKED MDS

APPROVED:

PRINCIPAL

DATE:

REVISIONS

REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	PDR
B	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

GENERAL

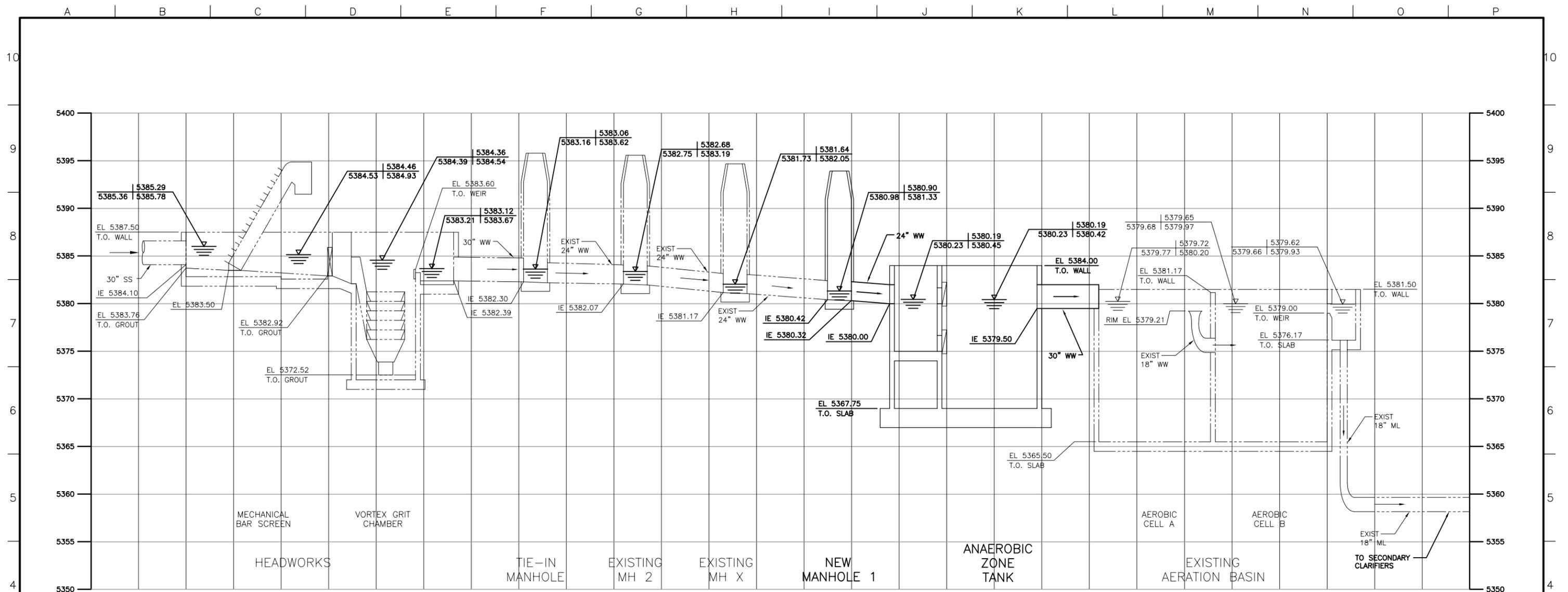
ABBREVIATIONS, GENERAL NOTES AND INSTRUMENTATION LEGENDS

DATE: 07/29/24

PROJECT NUMBER: 50161727

REVISION NO. B

DRAWING NUMBER G-2



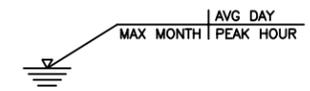
HYDRAULIC PROFILE
 SCALE: 1"=5' VERT
 NO SCALE HORIZ

BASIS OF HYDRAULIC PROFILE

FLOW CONDITION	TREATED FLOW (MGD)	MECHANICAL BAR SCREEN		GRIT BASIN		AERATION BASINS			CLARIFIERS		
		UNITS IN SERVICE/ UNITS AVAILABLE	TREATED FLOW PER UNIT (MGD)	UNITS IN SERVICE/ UNITS AVAILABLE	TREATED FLOW PER UNIT (MGD)	UNITS IN SERVICE/ UNITS AVAILABLE	TREATED FLOW PER UNIT (MGD)	RAS FLOW PER UNIT (MGD)	UNITS IN SERVICE/ UNITS AVAILABLE	TREATED FLOW PER UNIT (MGD)	RAS FLOW PER UNIT (MGD)
PEAK HOUR	4.68	1 OF 2	4.68	1 OF 1	4.68	2 OF 2	2.34	1.73	2 OF 2	2.34	1.73
MAXIMUM MONTH	2.17	1 OF 2	2.17	1 OF 1	2.17	2 OF 2	1.09	1.73	2 OF 2	1.09	1.73
AVERAGE DAY	1.73	1 OF 2	1.73	1 OF 1	1.73	2 OF 2	0.87	1.73	2 OF 2	0.87	1.73

- NOTES:**
 1. LOSSES THROUGH SCREENS BASED ON MANUFACTURER PROVIDED DATA.
 2. LOSSES THROUGH GRIT BASIN BASED ON MANUFACTURER PROVIDED DATA.

PLANT FLOW LEGEND:



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 Dewberry Engineers Inc.
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 (303) 825-1802

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 DRAWING GDG61727-004
 DRAWN JRA
 DESIGNED MDS
 CHECKED MDS

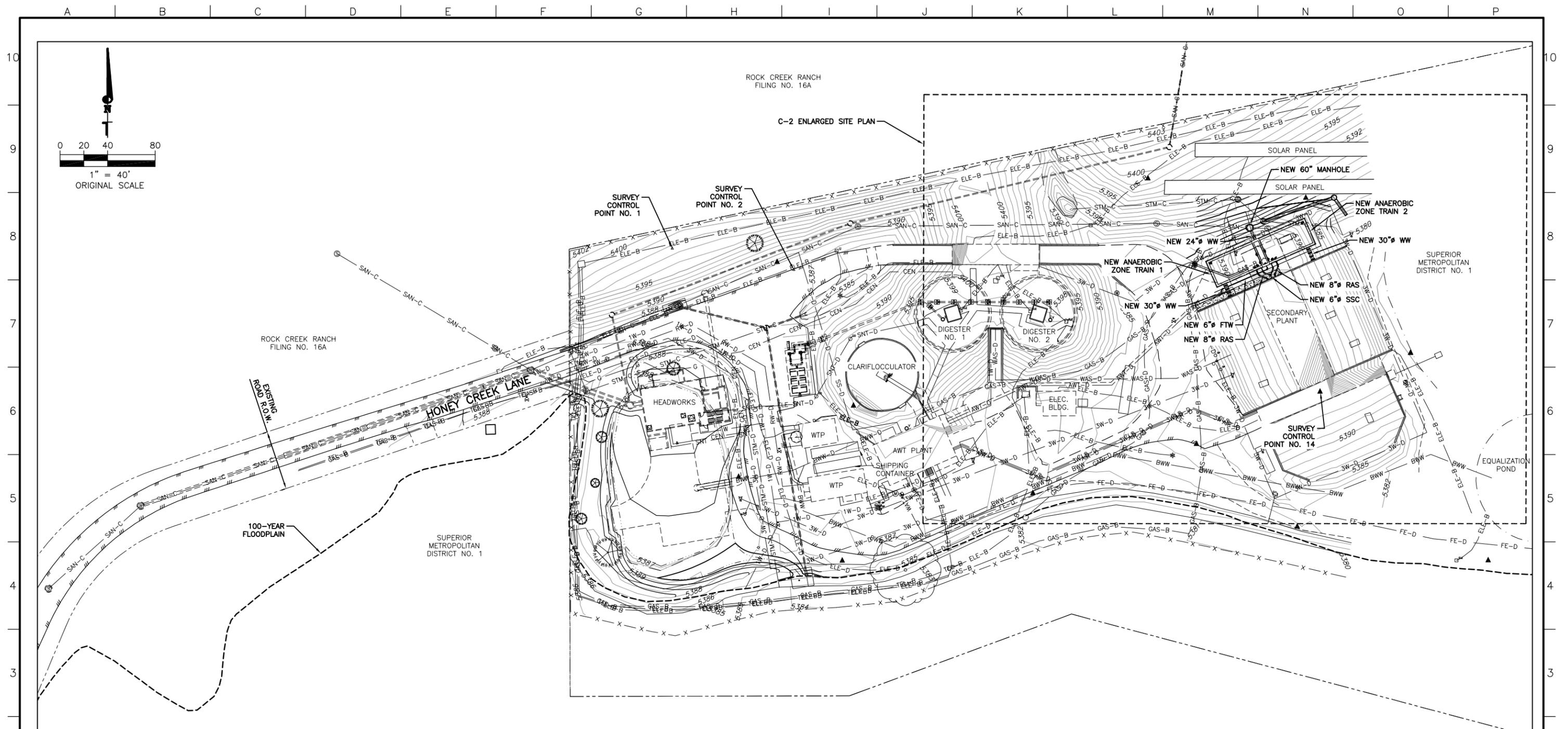
APPROVED:
 PRINCIPAL
 DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	PDR
B	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
 SUPERIOR, COLORADO
 ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

GENERAL
 HYDRAULIC PROFILE

DATE: 07/29/24
 PROJECT NUMBER: 50161727
 REVISION NO. B
 DRAWING NUMBER G-4



PROJECT CONTROL INFORMATION:

1.) HORIZONTAL CONTROL IS BASED ON A MODIFIED NAD 83-COLORADO STATE PLANE NORTH DATUM. DRAWING COORDINATES ARE SCALED TO GROUND BY A SCALE FACTOR OF 1.0002833740 UTILIZING THE FOLLOWING LOCATION AS THE POINT OF ORIGIN (AKA #1):
 LATITUDE=N39°56'17.70950"
 LONGITUDE=W105°08'28.40136"
 ELLIPSOID HEIGHT=5343.41'

2.) VERTICAL CONTROL IS BASED ON THE VRS NETWORK UTILIZING GEOID12B (NAVD88 DATUM).

SITE CONTROL TO BE USED FOR CONSTRUCTION LAYOUT:

INFORMATION LISTED BELOW AS: POINT NUMBER, NORTHING, EASTING, ELEVATION AND DESCRIPTION.

- 1, 1220557.4630, 3100603.5080, 5397.93, SET NO. 5 REBAR WITH RED PLASTIC CAP "PSM CONTROL"
- 2, 1220539.5200, 3100705.7550, 5387.54, SET MAG NAIL IN ASPHALT
- 14, 1220437.1110, 3101148.5610, 5381.03, SET MAG NAIL IN CONCRETE

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LINE IS 2 INCHES
 AT FULL SIZE
 (IF NOT 2"-SCALE ACCORDINGLY)

DRAWING CPL61727-1
 DRAWN JAJ
 DESIGNED MDS
 CHECKED MDS

APPROVED:

PRINCIPAL

DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JAJ	08/01/24	PDR
B	90% DESIGN REVIEW SUBMITTAL	JAJ	09/05/24	PDR

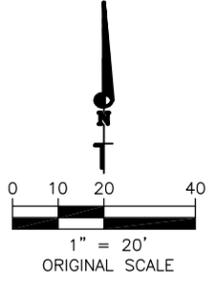
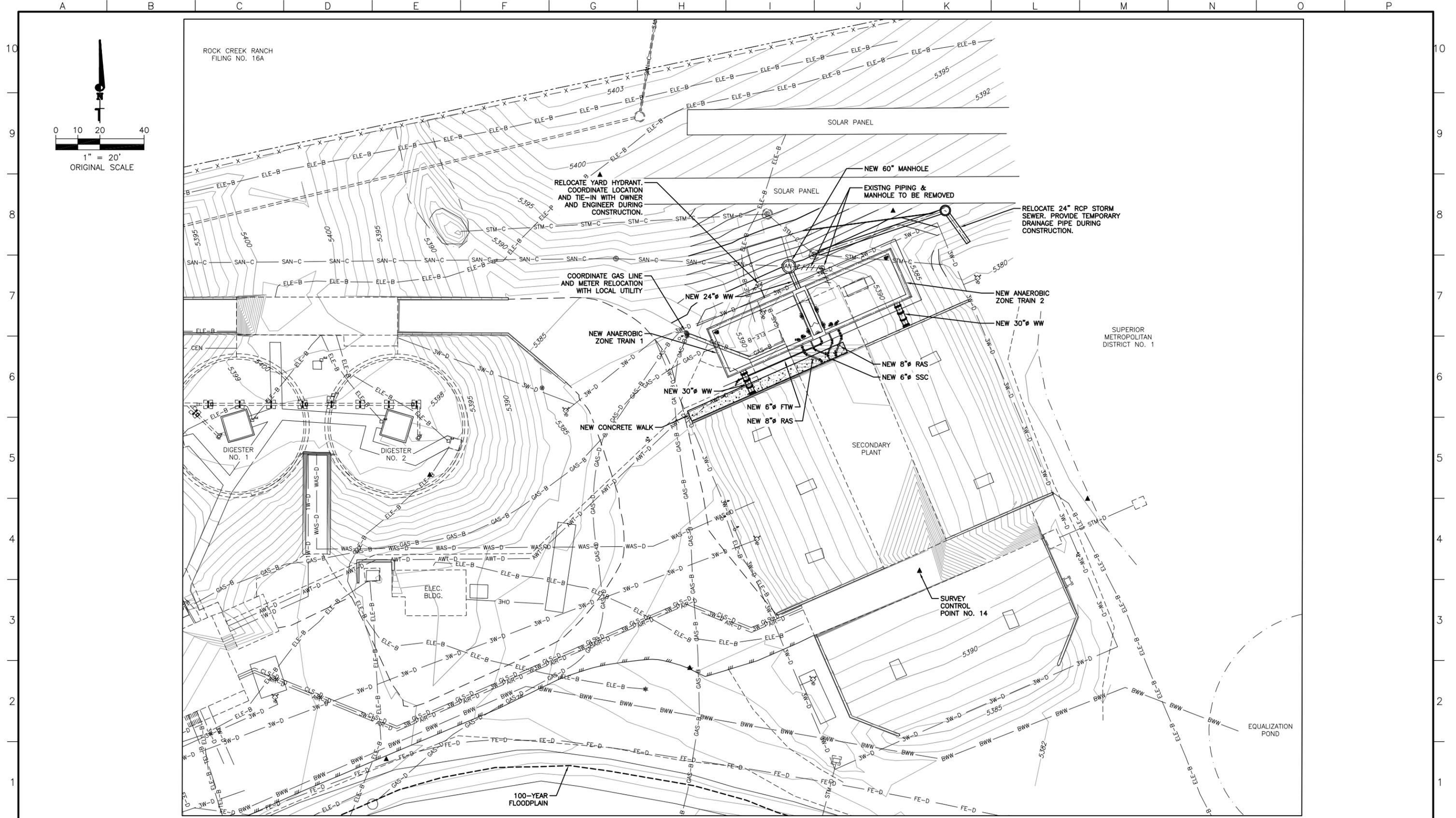
SUPERIOR METROPOLITAN DISTRICT NO. 1
 SUPERIOR, COLORADO

ROCK CREEK WWTf AERATION BASINS
 ANAEROBIC ZONE EXPANSION

CIVIL

OVERALL SITE PLAN

DATE: 07/29/24
 PROJECT NUMBER: 50161727
 REVISION NO. B
 DRAWING NUMBER
C-1
 SHEET NUMBER



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 Dewberry Engineers Inc.
 990 S. BROADWAY, SUITE 400
 Denver, Colorado 80209
 (303) 825-1802

LINE IS 2 INCHES
 AT FULL SIZE
 (IF NOT 2"=SCALE ACCORDINGLY)

DRAWING CPL61727-2
 DRAWN JAJ
 DESIGNED MDS
 CHECKED MDS

APPROVED: _____
 PRINCIPAL _____
 DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JAJ	08/01/24	PDR
B	90% DESIGN REVIEW SUBMITTAL	JAJ	09/05/24	PDR

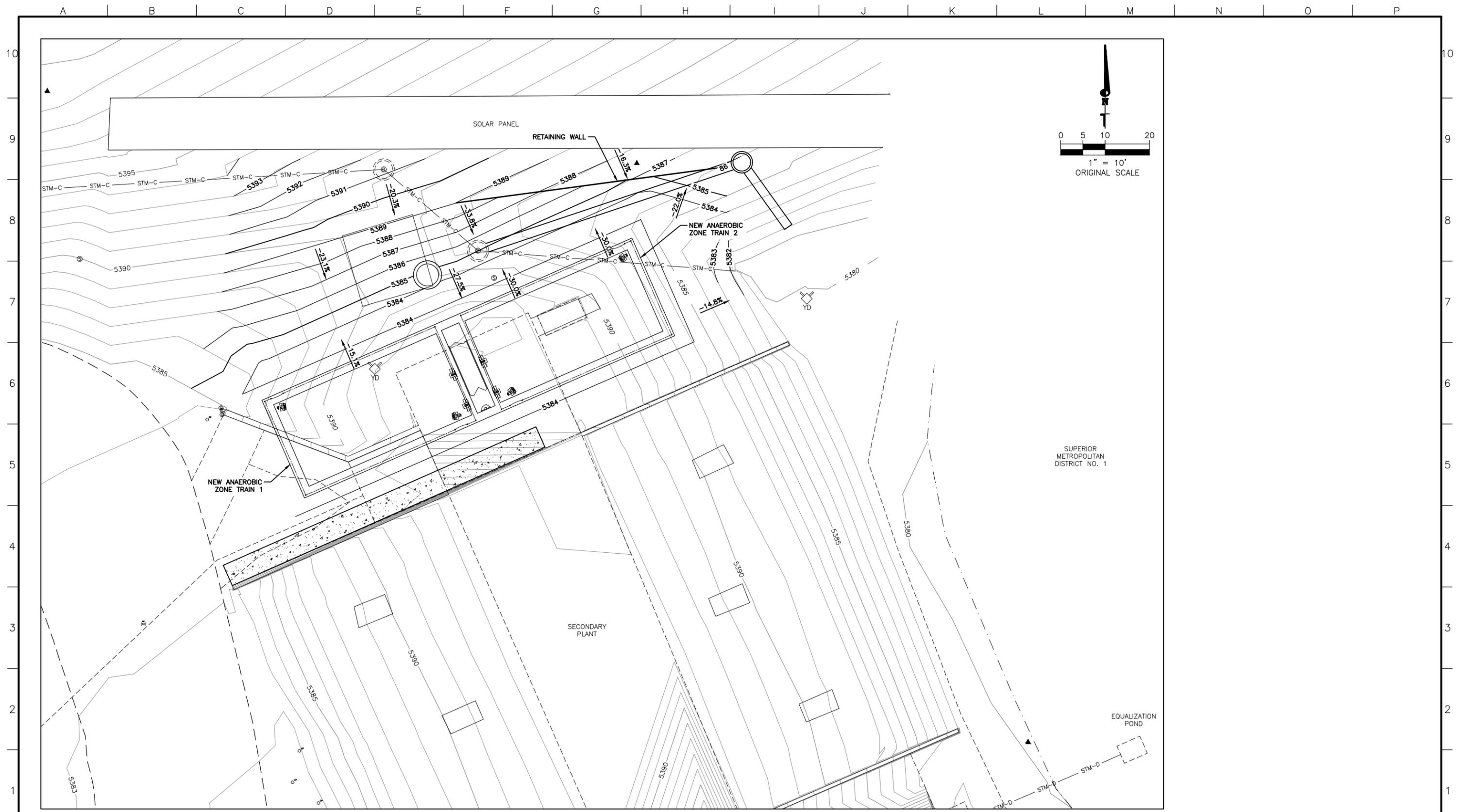
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTf AERATION BASINS
ANAEROBIC ZONE EXPANSION

CIVIL

ENLARGED SITE PLAN

DATE: 07/30/24
 PROJECT NUMBER: 50161727
 REVISION NO. B
 DRAWING NUMBER
C-2
 SHEET NUMBER



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 990 S. BROADWAY, SUITE 400
 Denver, Colorado 80209
 (303) 825-1802

LINE IS 2 INCHES
 AT FULL SIZE
 (IF NOT 2"=SCALE ACCORDINGLY)
 DRAWING CPL61727-3
 DRAWN TWL
 DESIGNED MDS
 CHECKED MDS

APPROVED:

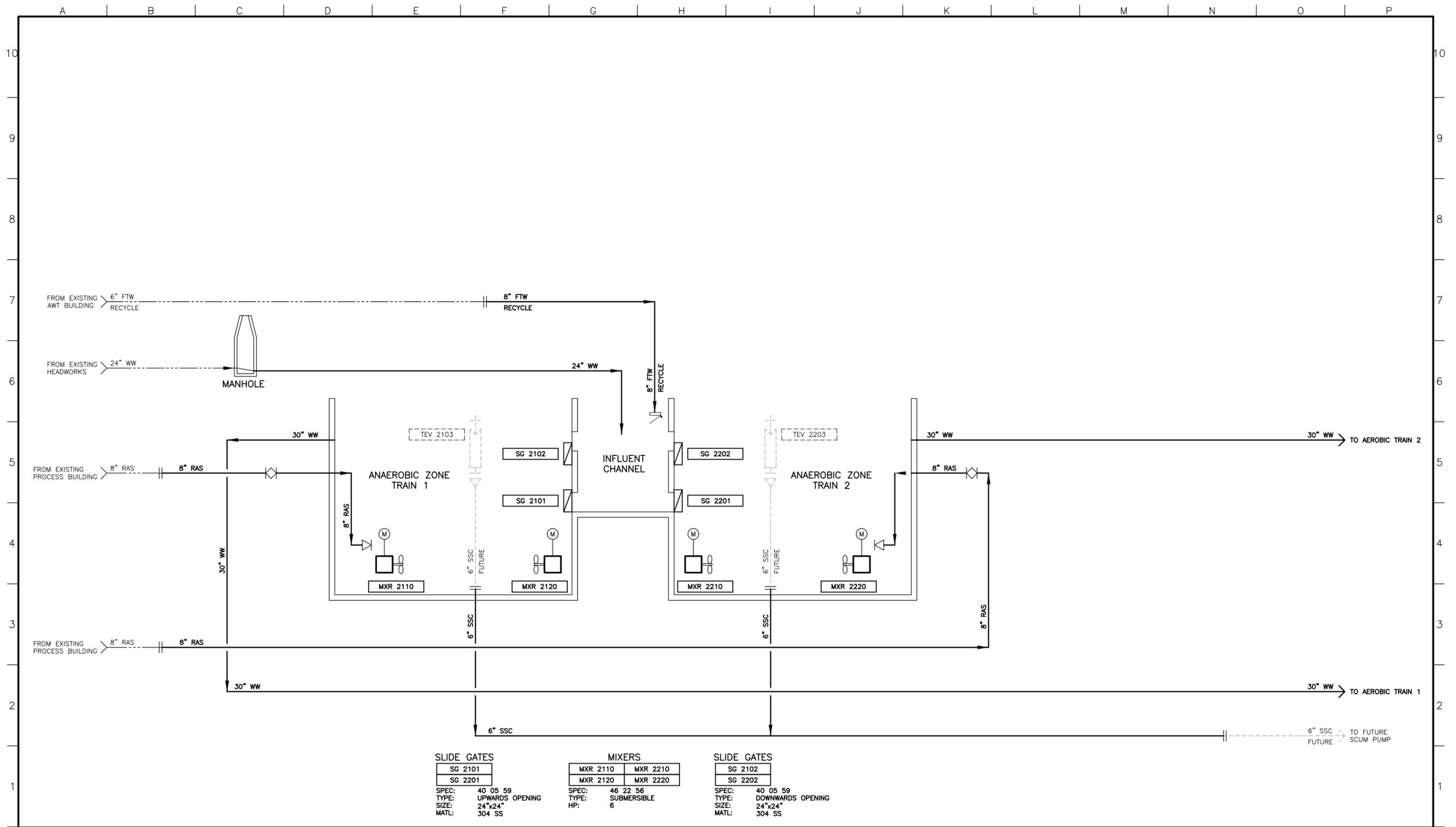
 PRINCIPAL
 DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	90% DESIGN REVIEW SUBMITTAL	TWL	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

CIVIL
ENLARGED GRADING PLAN

DATE: 09/04/24
 PROJECT NUMBER: 50161727
 REVISION NO. A
 DRAWING NUMBER
C-3
 SHEET NUMBER



SLIDE GATES

SG 2101
SG 2201

SPEC: 40 05 59
 TYPE: UPWARDS OPENING
 SIZE: 24"x24"
 MATL: 304 SS

MIXERS

MXR 2110	MXR 2210
MXR 2120	MXR 2220

SPEC: 46 22 56
 TYPE: SUBMERSIBLE
 HP: 6

SLIDE GATES

SG 2102
SG 2202

SPEC: 40 05 59
 TYPE: DOWNWARDS OPENING
 SIZE: 24"x24"
 MATL: 304 SS

990 S. BROADWAY, SUITE 400
 Denver, Colorado 80209
 (303) 825-1802

LINE IS 2 INCHES
 AT FULL SIZE
 (IF NOT 2"=SCALE ACCORDINGLY)

DRAWING PDG61727-2100
 DRAWN JRA
 DESIGNED MDS
 CHECKED MDS

APPROVED: _____
 PRINCIPAL
 DATE: _____

REVISIONS

REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	MDS
B	ISSUED FOR BID	JRA	09/05/24	PDR

**SUPERIOR METROPOLITAN DISTRICT NO. 1
 SUPERIOR, COLORADO**

**ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION**

PROCESS & INSTRUMENTATION DIAGRAM

ANAEROBIC ZONE TRAINS 1 AND 2

DATE: 07/29/24
 PROJECT NUMBER: 50161727
 REVISION NO. B
 DRAWING NUMBER
P-2100

GENERAL NOTES

G1. SCOPE
THESE NOTES ARE GENERAL AND APPLY TO THE ENTIRE PROJECT EXCEPT WHERE THERE ARE SPECIFIC INDICATIONS TO THE CONTRARY.

G2. APPLICABLE SPECIFICATIONS AND CODES
CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE 2018 EDITION OF THE IBC. THE ABOVE SHALL GOVERN EXCEPT WHERE OTHER APPLICABLE CODES OR THE FOLLOWING NOTES ARE MORE RESTRICTIVE.

A. ANY REFERENCE TO "LATEST EDITION" OR "LATEST VERSION" SHALL MEAN LATEST EDITION/VERSION AT THE TIME OF CONTRACT ISSUANCE OF 03/18/2021.

G3. ALTERNATIVE DESIGNS
THE STRUCTURAL SYSTEMS AND DETAILS ON THESE PLANS ARE THE PRIORITY DESIGN. ALTERNATIVE SYSTEMS AND DETAILS MAY BE USED IF THE CONTRACTOR SUBMITS PLANS WITH SUBSTANTIATING CALCULATIONS AND TEST DATA, AND IF THE ALTERNATIVE PLANS ARE ACCEPTED BY THE CONSTRUCTION MANAGER AND OWNER.

G4. DIMENSIONS
STRUCTURAL DIMENSIONS CONTROLLED BY OR RELATED TO MECHANICAL OR ELECTRICAL EQUIPMENT SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

G5. PROVISIONS FOR EQUIPMENT
DETAILS OF MECHANICAL AND ELECTRICAL EQUIPMENT SUPPORTS, ANCHORAGES, OPENINGS, RECESSES, PIPING, AND EMBEDMENTS NOT SHOWN ON THE STRUCTURAL DRAWINGS BUT REQUIRED BY OTHER CONTRACT DRAWINGS SHALL BE PROVIDED PRIOR TO CASTING CONCRETE.

G6. CONSTRUCTION LOADS
STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON COMPLETED STRUCTURES. DURING CONSTRUCTION, STRUCTURES SHALL BE PROTECTED BY BRACING AND SHORING WHEREVER EXCESSIVE LOADS MAY OCCUR.

G7. DESIGN LIVE LOADS
A. GRATINGS, CHECKER PLATES, AND HATCHES - SAME LOADINGS AS ADJACENT FLOOR AREAS
B. STAIRS - 100 PSF
C. WALKWAYS - 100 PSF
D. SEISMIC - 2018 I.B.C. CHAPTER 16
1. RISK CATEGORY = III
2. GROUND MOTION; $S_s = 0.222$ G, 0.2 SECOND RESPONSE
 $S_1 = 0.06$ G, 1.0 SECOND RESPONSE
3. DESIGN SPECTRAL ACCELERATION; $S_{ds} = 0.237$, $S_{d1} = 0.096$
4. SITE CLASSIFICATION = D
5. SEISMIC DESIGN CATEGORY = D
E. LATERAL EARTH PRESSURE
(1) 95 PCF/FT SATURATED SOIL
F. SOIL BEARING PRESSURE:
THE MAXIMUM ALLOWABLE SOIL BEARING PRESSURE = 2,000 PSF.
G. BUILDING CODE:
1. 2018 INTERNATIONAL BUILDING CODE(2018 I.B.C.) WITH ASCE 7-16 MINIMUM DESIGN LOADS AND ASSOCIATED CRITERIA FOR BUILDINGS AND OTHER STRUCTURES AND ACI 350-06 CODE REQUIREMENTS FOR ENVIRONMENTAL ENGINEERING CONCRETE STRUCTURES.
2. UNIFIED FACILITIES CRITERIA(UFC) STRUCTURAL ENGINEERING.

G8. SOILS
SEE GEOTECHNICAL EVALUATION REPORTS, PROJECT NO. 19-3-152, DATED JUNE 20, 2019. PROVIDED BY KUMAR & ASSOCIATES, INC.

G9. DRAINAGE SURFACES
SLOPE DRAINAGE SURFACE UNIFORMLY TO DRAIN. SLOPE SHALL BE 1/8" PER FOOT EXCEPT WHERE NOTED OTHERWISE ON THE PLANS.

G10. FLOOR DRAINS
SLOPE FLOOR TO DRAIN AT ELEVATIONS NOTED. SEE MECHANICAL DRAWINGS FOR SIZES AND TYPES.
FLOODPROOFING DESIGN CRITERIA
THE DESIGN OF ALL OF THE BELOW GRADE STRUCTURES REGARDLESS OF THEIR PROXIMITY TO THE 100 YEAR FLOODPLAIN INCLUDE ENVIRONMENTAL REQUIREMENTS LISTED IN ACI-350 THAT ALSO ADDRESS FLOODPROOFING DESIGN CRITERIA. THE DESIGN CRITERIA SPECIFIC TO FLOODPROOFING CONSIDERATIONS ARE AS FOLLOWS:
A. ALL BELOW GRADE STRUCTURES ARE DESIGNED TO BE WATER-TIGHT FROM BOTH THE INNER AND OUTER WALL AND SLAB SURFACES. THE CONCRETE MEMBERS ARE DESIGNED TO RESIST HYDROSTATIC AND SATURATED SOIL LOADING. WATERSTOPS ARE INSTALLED AT ALL CONSTRUCTION JOINTS.
B. THE STRUCTURES ARE DESIGNED TO RESIST BUOYANT FORCES.
C. THE BELOW GRADE PORTIONS OF THE STRUCTURES ARE FOUNDED AT DEPTHS THAT ELIMINATE THE POSSIBILITY OF SCOUR.

D. THE ALLOWABLE SOIL BEARING PRESSURE IN SATURATED CONDITIONS HAS BEEN VERIFIED AND THAT CRITERIA HAS BEEN USED IN OUR DESIGN. ADDITIONALLY, IT HAS BEEN DETERMINED THAT LIQUEFACTION OF SATURATED SOIL WILL NOT BE A CONCERN ON THIS SITE.

CONCRETE

C1. APPLICABLE CODE
CONCRETE CONSTRUCTION SHALL CONFORM TO THE ACI 301 SPECIFICATIONS FOR BUILDINGS, AND ACI 350 ENVIRONMENTAL STRUCTURES.

C2. REINFORCING STEEL DETAILS
ALL DETAILING, FABRICATION, AND ERECTION OF REINFORCING BARS, UNLESS OTHERWISE NOTED SHALL BE IN ACCORDANCE WITH MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES (ACI-315).

C3. DESIGN STRENGTHS
A. CONCRETE, $F_c = 4500$ PSI ULTIMATE COMPRESSIVE STRENGTH AT 28 DAYS AND AS OTHERWISE SPECIFIED.
B. REINFORCING STEEL, ASTM A615, GR.60, EXCEPT FOR TIES, STIRRUPS, AND BARS NOTED ON DRAWINGS TO BE FIELD BENT, WHICH SHALL BE GRADE 40. BARS TO BE WELDED SHALL BE ASTM A706.

C4. CONCRETE COVER
CONCRETE COVER FOR REINFORCING BARS SHALL BE AS FOLLOWS WITH MINIMUM COVER OF ONE BAR DIAMETER.
A. CONCRETE CAST AGAINST EARTH - 3 INCHES.
B. CONCRETE TO BE IN CONTACT WITH LIQUID - 2 INCHES UNLESS OTHERWISE NOTED.
C. CONCRETE TO BE IN CONTACT WITH EARTH OR WEATHER.
1. BARS GREATER THAN #5 - 2 INCHES.
2. BARS #5 OR LESS - 1-1/2 INCHES.
D. CONCRETE NOT TO BE EXPOSED TO GROUND, WEATHER, OR LIQUID.
1. BEAMS AND COLUMNS - 1-1/2 INCHES.
2. SLABS, WALLS, AND JOISTS - 1 INCH.

C5. MINIMUM REINFORCEMENT
CONCRETE CONSTRUCTION SHALL BE REINFORCED CONCRETE EXCEPT WHERE PLAIN CONCRETE IS INDICATED ON THE DRAWINGS. UNLESS OTHERWISE NOTED, MINIMUM TEMPERATURE AND SHRINKAGE STEEL SHALL BE PROVIDED IN ACCORDANCE WITH ACI-350.

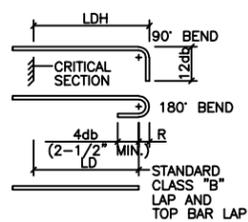
C6. ADDED TOP STEEL IN SLABS, EXCEPT AS NOTED ON DRAWINGS WHERE BEAMS OR WALLS ARE PARALLEL TO MAIN REINFORCING IN SLAB, PROVIDE #4 AT 18" TOP OF SLAB - NORMAL TO BEAM OR WALL AND EXTEND BARS 2'-0" BEYOND FACE OF BEAM OR WALL. WHEN SLAB IS ON ONE SIDE ONLY, TERMINATE BARS WITH STANDARD HOOK ON SIDE AWAY FROM SLAB.

C7. EXTRA ACCESSORY BARS
IN ADDITION TO NORMAL ACCESSORIES USED TO HOLD REINFORCING STEEL FIRMLY IN POSITION, EXTRA ACCESSORY BARS SHALL BE USED AS FOLLOWS:
A. IN SLABS #5 RAISER BARS AT 36" O.C. MAXIMUM TO SUPPORT TOP REINFORCING STEEL.
B. IN WALLS WITH TWO CURTAINS #3 U OR Z SHAPE SPACERS AT 6 FEET ON CENTER, EACH WAY

C8. BAR LAP SPLICES AND EMBEDMENT LENGTH DOWELS
SHALL BE THE SAME SIZE AND SPACING AS BARS WITH WHICH THEY ARE LAPPED UNLESS OTHERWISE NOTED. ALL BAR SPLICES SHALL BE LAPPED, OR EMBEDDED, AS FOLLOWS UNLESS OTHERWISE NOTED.

C9. RESTRICTED BAR ANCHORAGE IN CASES WHERE REINFORCING BARS CANNOT BE EXTENDED AS FAR AS REQUIRED DUE TO THE LIMITED EXTENT OF THE ADJACENT CONCRETE STRUCTURE, THE BARS SHALL EXTEND AS FAR AS POSSIBLE AND END IN STANDARD HOOKS.

REBAR SPLICE AND HOOK SCHEDULE				
ASTM BAR SIZE	LD	CLASS B LAP	TOP BAR LAP	LDH
3	15"	19"	24"	6"
4	19"	25"	32"	7"
5	24"	31"	40"	9"
6	29"	37"	48"	12"
7	42"	54"	70"	15"
8	48"	62"	80"	18"
9	54"	70"	91"	21"
10	61"	79"	102"	25"



NOTES:
TOP BAR - DEFINED AS A BAR LOCATED SUCH THAT 12 IN. OR MORE OF FRESH CONCRETE IS CAST IN THE MEMBER BELOW THE SPLICE.
MINIMUM OUTSIDE RADIUS OF BEND, R, SHALL BE 4db.
LD - STANDARD DEVELOPMENT LENGTH OF BAR
LDH - STANDARD DEVELOPMENT LENGTH OF HOOK
db - BAR DIAMETER

C10. STANDARD HOOKS
BARS ENDING IN A RIGHT ANGLE BEND OR HOOK SHALL CONFORM TO THE REQUIREMENTS OF TABLE 1 OF ACI-315.

C11. SLOPING SLABS
MONOLITHIC SLABS WITH TOPS THAT ARE SLOPED SHALL HAVE BOTTOMS SLOPED THE SAME AMOUNT, MAINTAINING A UNIFORM SLAB THICKNESS, UNLESS OTHERWISE SHOWN.

C12. GROUND SUPPORTED SLABS
CONCRETE SLABS SUPPORTED BY GROUND, UNLESS OTHERWISE NOTED, SHALL BE 4" THICK REINFORCED WITH 4x4-6/8 WWF AT MID-DEPTH OF SLAB AND DOWELED ALONG THE EDGE OF SLAB TO ALL ADJACENT WALLS, COLUMNS, AND FOUNDATIONS WITH #4 DOWELS X 2'-0" THAT LAP 1'-0" WITH WWF AND EXTEND INTO WALLS, COLUMNS, AND FOUNDATIONS AT LEAST 9". IF SLAB IS DESIGNATED AS "ISOLATED SLAB" ON DRAWINGS, OMIT DOWELS AND SUBSTITUTE 3/8" THICK PREFORMED CLOSED CELL FOAM JOINT FILLER TO ISOLATE THE SLAB FROM CONTACT WITH THE STRUCTURE ALONG ITS PERIMETER. (SEE STRUCTURAL DRAWINGS)

C13. CHAMFERS
EXCEPT AS OTHERWISE REQUIRED, EXPOSED CONCRETE CORNERS AND EDGES SHALL HAVE 3/4" CHAMFERS. REENTRANT CORNERS SHALL NOT HAVE FILLETS.

C14. ANCHOR BOLTS
USE OF ANCHOR BOLTS SHALL BE IN ACCORDANCE WITH DETAIL. ALL ANCHOR BOLTS SHALL BE STAINLESS STEEL U.N.O.

ELEVATIONS

E1. DATUM
ELEVATIONS ARE BASED ON INFORMATION SHOWN ON THE CIVIL DRAWINGS.

E2. GENERAL
WHERE ELEVATIONS ARE GIVEN AS DOUBLE DIGIT NUMBERS SUCH AS 72.75, THIS SHALL MEAN 6472.75 WHERE GIVEN AS TRIPLE DIGIT NUMBERS SUCH AS 472.75, THIS SHALL MEAN 6472.75.

E3. VERIFY EXISTING ELEVATIONS
ALL ELEVATIONS NOTED FOR EXISTING CONSTRUCTION ARE APPROXIMATE. (SEE NOTE M7)

FIELD VERIFICATION OF EXISTING CONSTRUCTION

F1. GENERAL
DIMENSIONS AND ELEVATIONS OF EXISTING CONSTRUCTION ARE SHOWN FOR BIDDING ONLY.

F2. VERIFICATION REQUIRED
CONTRACTOR SHALL THOROUGHLY INSPECT AND SURVEY EXISTING CONSTRUCTION TO VERIFY DIMENSIONS, ELEVATIONS, ETC. WHICH AFFECT THE WORK SHOWN ON THE DRAWINGS.

F3. REPORTING DISCREPANCIES
REPORT ANY VARIATIONS OR DISCREPANCIES TO THE OWNER BEFORE PROCEEDING.

METAL FABRICATIONS:

1. HANDRAILS AND GUARDRAILS:
A. ALUMINUM, EXCEPT WHERE OTHER MATERIALS ARE NOTED.

2. GRATING:
A. ALUMINUM WITH TYPE 316 STAINLESS STEEL FASTENERS, UNLESS OTHERWISE NOTED.
B. GRATING AND ITS SEATS OR SUPPORTS SHALL BE THE SAME MATERIAL.
C. UNLESS INDICATED ON THE DRAWINGS AS "REMOVABLE GRATING", SECURELY FASTEN GRATING.

3. COVER PLATES:
A. ALUMINUM WITH TYPE 316 STAINLESS STEEL FASTENERS, UNLESS OTHERWISE NOTED.
B. COVER PLATE AND ITS SEATS OR SUPPORTS SHALL BE OF THE SAME MATERIAL.

SPECIAL INSPECTION:

1. SPECIAL INSPECTION IS REQUIRED FOR THE FOLLOWING STRUCTURAL MATERIALS AND CONSTRUCTION.

2. DIVISION 2 SITE CONSTRUCTION (EARTHWORK)
A. EXCAVATION DEPTH.
B. ADEQUACY OF EXPOSED SURFACES TO PROVIDE REQUIRED SUPPORT.
C. PREPARATION OF SOILS / SURFACES SUPPORTING CONSTRUCTION.
D. FILL AND BACKFILL.
E. DEEP FOUNDATIONS PILES DRILLED PIERS HELICAL ANCHORS.

3. DIVISION 3 CONCRETE:
A. LOCATIONS.
B. FORMWORK AND MEMBER SIZES.
C. REINFORCING STEEL.
D. ANCHORS: CAST-IN AND POST-INSTALLED.
E. CONCRETE AND MIX AND PLACEMENT.
F. PROTECTION AND CURING PROCEDURES.
G. PRESTRESSED CONCRETE.
H. PRECAST CONCRETE.

STRUCTURAL OBSERVATION:

1. STRUCTURAL OBSERVATION IS REQUIRED DURING AND AT SPECIFIC STAGES OF CONSTRUCTION.
A. SPECIAL TEST AND INSPECTIONS OF STRUCTURAL ASSEMBLIES AND COMPONENTS TO BE PERFORMED IN COMPLIANCE WITH IBC. STRUCTURAL OBSERVATIONS ARE REQUIRED FOR SEISMIC RESISTANCE, LIST OF STRUCTURES REQUIRING OBSERVATION ARE AS FOLLOWS. CONTRACTOR TO COORDINATE WITH SEOR FOR SCHEDULING OBSERVATIONS BEFORE PLACEMENT OF CONCRETE.
B. DUTIES OF SPECIAL INSPECTOR:
1.) GENERAL: REQUIRED DUTIES OF THE SPECIAL INSPECTOR ARE DESCRIBED IN IBC.
2.) SELECTION OF THE MATERIAL REQUIRED TO BE TESTED SHALL BE BY THE OWNER'S TESTING LABORATORY AND NOT THE CONTRACTOR.
C. SPECIAL TESTING AND INSPECTIONS:
A. OWNER RESERVES THE RIGHT TO POSITIVE MATERIAL IDENTIFICATION TEST:
1. CONTRACTOR MUST MAKE MATERIAL S AVAILABLE FOR TESTING.
B. THE FOLLOWING TYPES OF WORK REQUIRE SPECIAL INSPECTION AS DESCRIBED IN IBC, REFER TO THE FOLLOWING VERIFICATION, TESTING AND INSPECTION SCHEDULES:
1. CAST-IN-PLACE CONCRETE SPECIAL INSPECTION SCHEDULE.
2. ESSENTIAL ARCHITECTURAL, MECHANICAL AND ELECTRICAL INSPECTION SCHEDULE.
3. SOILS VERIFICATION AND INSPECTION SCHEDULE.
4. STRUCTURAL STEEL SPECIAL INSPECTION SCHEDULE.

STRUCTURE ABBREVIATIONS LIST

A.B.	AGGREGATE BASE	EQ.	EQUAL EACH WAY	PSI	POUNDS PER SQUARE INCH
AL	ALUMINIUM	EW.	EXISTING EXPANSION	PSF	POUNDS PER SQUARE FOOT
ALT	ALTERNATIVE	EXST.	EXISTING	R	RADIUS
B.S.	BOTH SIDES	EXP.	EXPANSION	REINF.	REINFORCING
BOT.	BOTTOM	FTG.	FOOTING	REQ'D.	REQUIRED
CF	CUBIC FOOT	GALV.	GALVANIZED	STD.	STANDARD
C/L	CENTERLINE	GA.	GAUGE	SSSF	STAINLESS STEEL FLAT HEAD
CLR.	CLEAR	HSS	HOLLOW STRUCTURAL SECTION	SST	STAINLESS STEEL
COL.	COLUMN	HORIZ.	HORIZONTAL	SYMM.	SYMMETRICAL
CONC.	CONCRETE	KSI.	KIPS PER SQUARE INCH	T & B	TOP AND BOTTOM
CONT.	CONTINUOUS	LLV	LONG LEG VERTICAL	T.O.	TOP OF
DET.	DETAIL	MAX.	MAXIMUM	TOT.	TOTAL
DIA., Ø	DIAMETER	MIN.	MINIMUM	TYP.	TYPICAL
DIM.	DIMENSION	MPH	MILES PER HOUR	U.N.O.	UNLESS NOTED OTHERWISE
DWG	DRAWING	N.T.L.	NOT TO SCALE	V.I.F.	VERIFY IN FIELD
EA.	EACH	#	NUMBER	VERT.	VERTICAL
E.F.	EACH FACE	O.C.	ON CENTER	W.P.	WORKING POINT
ELEV.	ELEVATION	PL	PLATE	WSTP	WATERSTOP

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)
DRAWING SPL61727-0001
DRAWN DS
DESIGNED MH
CHECKED MDS

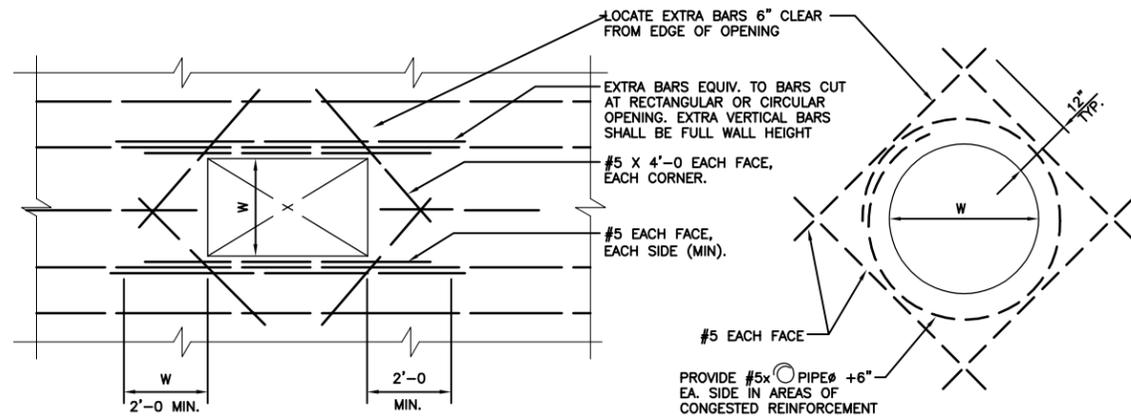
APPROVED:
PRINCIPAL
DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

STRUCTURAL
STANDARD DETAILS

DATE: 09/02/24
PROJECT NUMBER: 60161727
REVISION NO. A
DRAWING NUMBER S-1

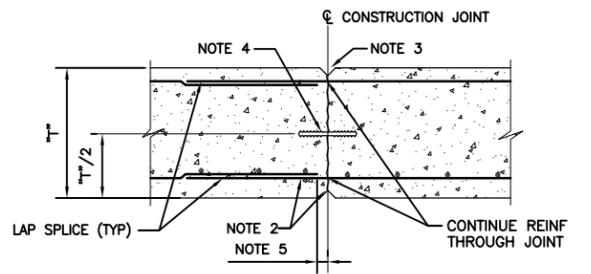
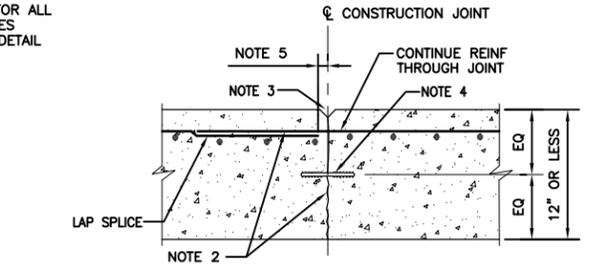
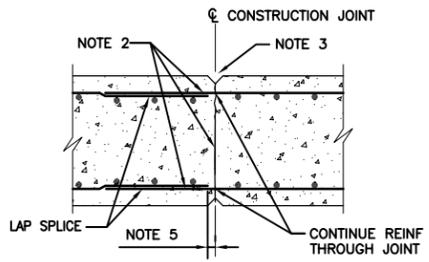
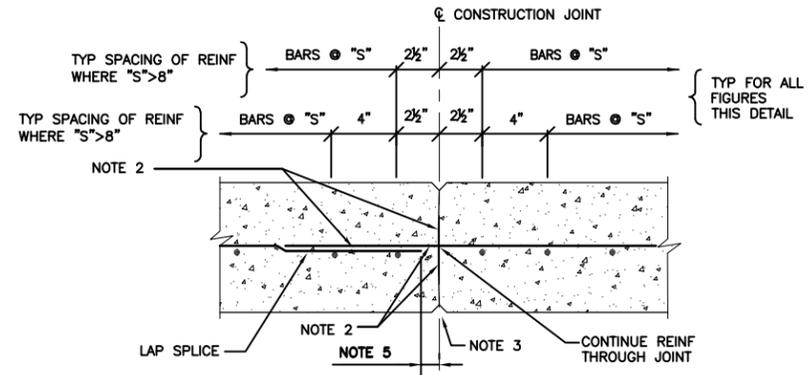


REINFORCEMENT AT SLAB AND WALL OPENINGS

NOTES:

1. TRANSVERSE REINFORCEMENT NOT SPECIFIED, BUT SHALL BE TREATED IN SAME MANNER AS BARS SHOWN.
2. W = DIMENSION OF OPENING PERPENDICULAR TO BARS CUT. W = DIAMETER FOR CIRCULAR OPENINGS. BAR PROJECTION BEYOND OPENING SHALL BE NO LESS THAN SPECIFIED LAP LENGTH.
3. SUPPLEMENTARY REINFORCING MAY BE OMITTED ONLY WHERE OPENING REINFORCING IS NOT CUT.
4. SUPPLEMENTARY REINFORCING IS NOT REQUIRED WHEN SPECIFIED

1 DETAIL REINFORCEMENT AT SLAB AND WALL OPENINGS
NO SCALE



NOTES:

1. "S" EQUALS TYPICAL BAR SPACING INDICATED ON THE DRAWINGS.
"T" EQUALS SLAB OR WALL THICKNESS.
2. ROUGHEN EXPOSED JOINT FACE TO A 1/4" AMPLITUDE AND PROJECTING REINFORCEMENT BEFORE PLACING CONCRETE.
3. JOINT EDGES:
A. FOR WALLS AND BOTTOMS OF EXPOSED SLABS: FORM EDGES WITH 1/2" CHAMFER.
B. FOR SLABS: EDGE TOP AND ENDS WITH 1/4" RADIUS.
4. 6" WATERSTOP CENTERED ON JOINT—SEE DETAIL 4/TYP. THOROUGHLY CLEAN CLEAN WATERSTOP BEFORE PLACING CONCRETE IN SECOND POUR.
5. STOP REINFORCING 2" CLEAR OF JOINT.

2 DETAIL CONSTRUCTION JOINTS
NO SCALE

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES AT FULL SIZE
(IF NOT 2"-SCALE ACCORDINGLY)
DRAWING SPL61727-0002
DRAWN DS
DESIGNED MH
CHECKED MDS

REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

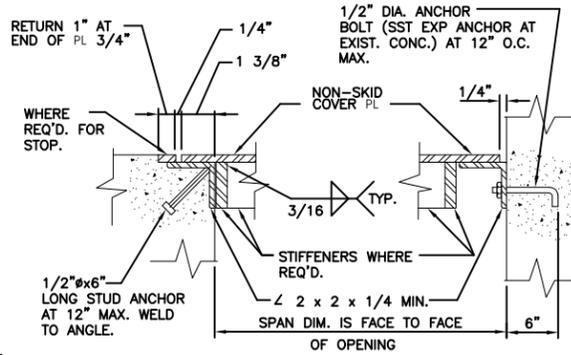
APPROVED: _____
PRINCIPAL
DATE: _____

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

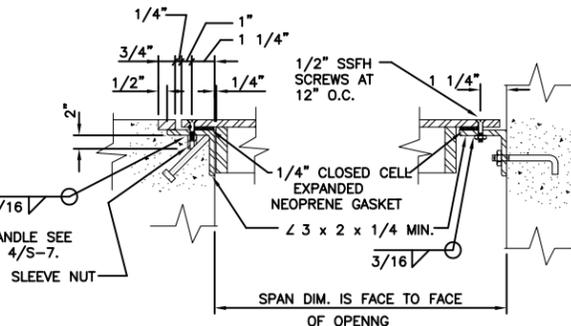
STRUCTURAL
STANDARD DETAILS

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER S-2

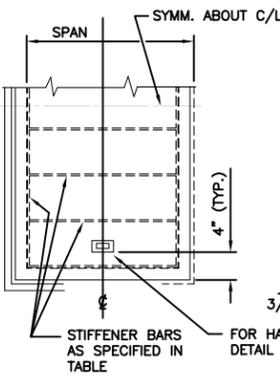
MINIMUM REQUIREMENTS FOR COVER PLATES			
MAX. SPAN	PLATE THICKNESS (INCHES)	BAR SIZE (INCHES)	SPACING (INCHES)
2'-0"	1/4"	-	-
5'-0"	1/4"	3/8 x 2	12
7'-0"	1/4"	3/8 x 2	8



LOOSE COVER PLATE AND SUPPORTS



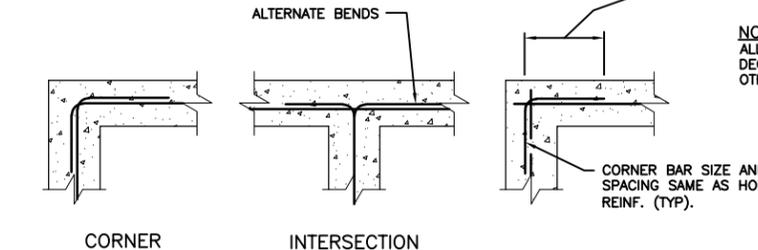
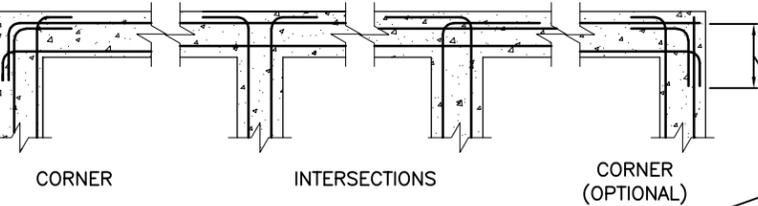
BOLTED COVER PLATE AND SUPPORTS



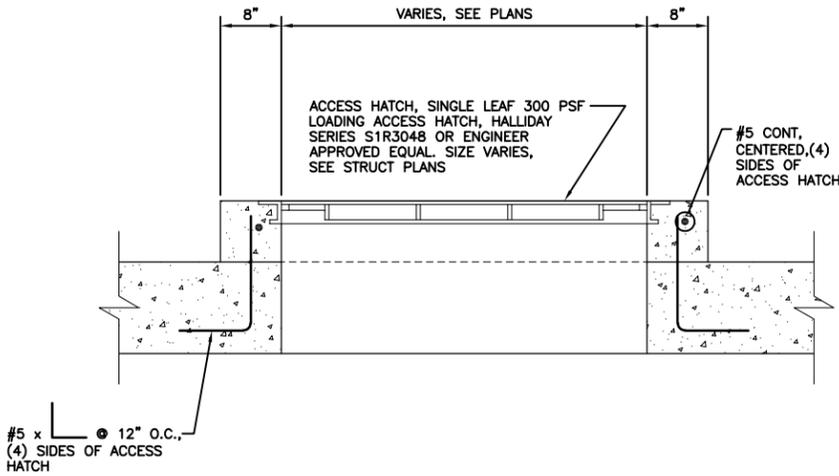
COVER PLATE PLAN

1 DETAIL DIAMOND PLATE COVERS
NO SCALE

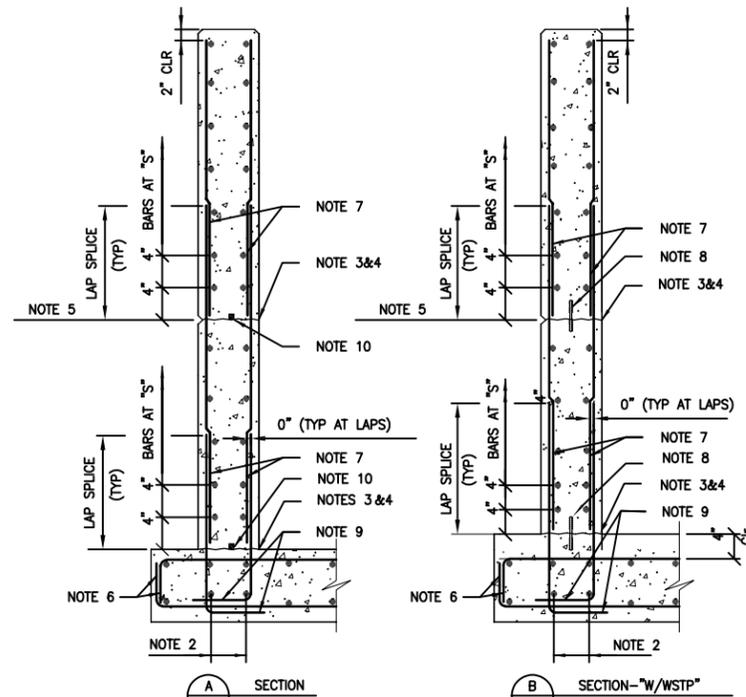
NOTE:
 WHERE ADDITIONAL CORNER BARS ARE REQUIRED AT "TEE" WALL INTERSECTIONS PROVIDE ADDITIONAL HOOKED BARS AS SHOWN AND ADDITIONAL STRAIGHT HORIZONTAL BARS ON BOTH FACES OF THE PERPENDICULAR INTERSECTING WALL.



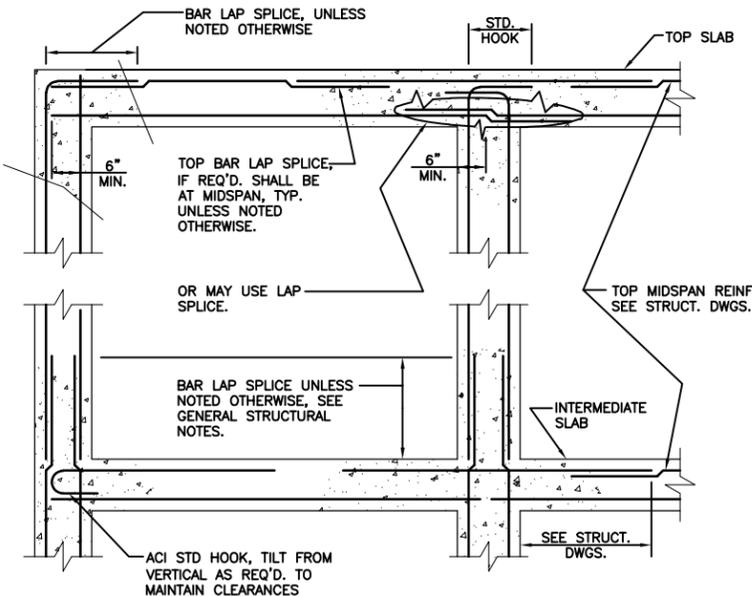
3 DETAIL REINFORCING STEEL AT WALL INTERSECTIONS
NO SCALE



2 DETAIL ACCESS HATCH CURB
NO SCALE



- NOTES:
- "S" EQUALS TYPICAL BAR SPACING INDICATED ON THE DRAWINGS.
 - PLACE AND ALIGN BARS BEFORE PLACING DOWELS. BAR SIZE TO MATCH SLAB BARS.
 - WATER-BLAST JOINT FACE AND PROJECTING REINFORCEMENT BEFORE PLACING CONCRETE.
 - PLACE CEMENT GROUT OVER JOINT FACE IMMEDIATELY BEFORE PLACING CONCRETE. (SEE SPECIFICATIONS).
 - CONSTRUCTION JOINT WHERE INDICATED ON THE DRAWINGS. WHERE WALL SURFACE IS EXPOSED TO VIEW IN THE FINISHED WORK, PROVIDE V-GROOVE.
 - STANDARD 90° HOOK WHERE INDICATED ON THE DRAWINGS. (ALTERNATE: PROVIDE 180° HOOK WHERE REQUIRED BY SLAB THICKNESS).
 - DOWELS: SAME SIZE AND SPACING AS VERTICAL WALL BARS, UNLESS OTHERWISE NOTED.
 - 6" PVC WATERSTOP CENTERED VERTICALLY ON JOINT. PROVIDE WIRE TIES MAX 2'-0" OC. HOG RINGS MAY BE USED IN LIEU OF WIRE LOOPS. THOROUGHLY CLEAN WATERSTOP BEFORE PLACING CONCRETE.
 - STANDARD 90° HOOK UNLESS OTHERWISE INDICATED ON THE DRAWINGS.
 - WHERE DRAWINGS INDICATE "W/STRIPS WSTP" PROVIDE LOW EXPANSION HYDROPHILIC WATERSTOP AT TOP SURFACE OF JOINT AND CENTERED BETWEEN VERTICAL BARS.



4 DETAIL REINFORCING STEEL AT WALL/SLAB INTERSECTIONS
NO SCALE

5 DETAIL CONSTRUCTION JOINT WALLS
NO SCALE

Dewberry
 Dewberry Engineers Inc.
 990 S. BROADWAY, SUITE 400
 Denver, Colorado 80209
 (303) 825-1802

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"=SCALE ACCORDINGLY)
 DRAWING SPL61727-0003
 DRAWN DS
 DESIGNED MH
 CHECKED MDS

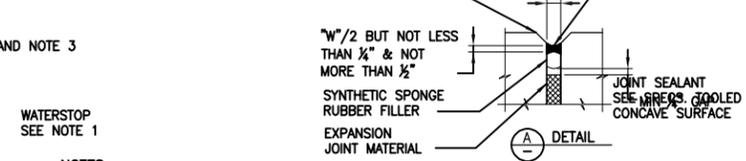
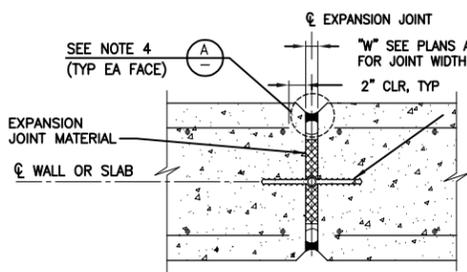
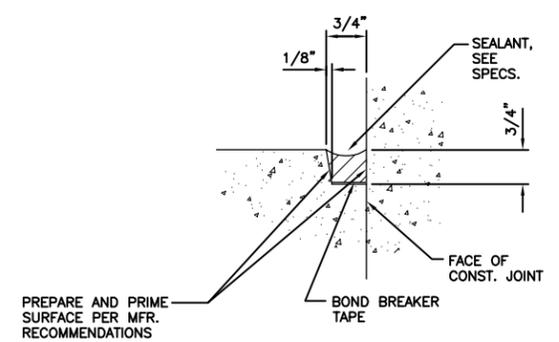
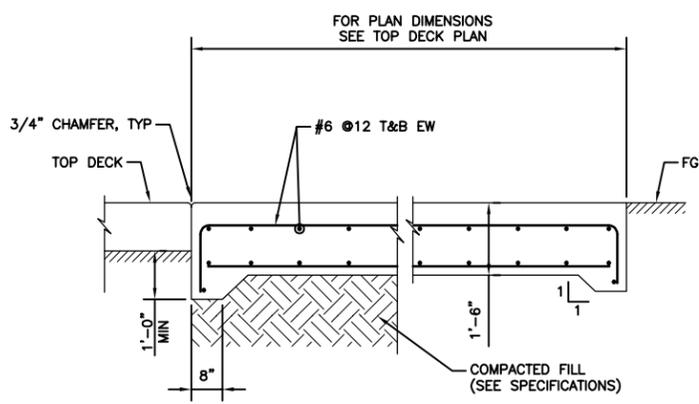
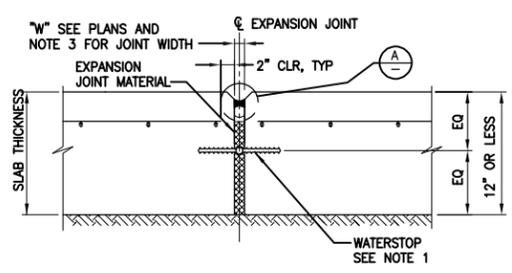
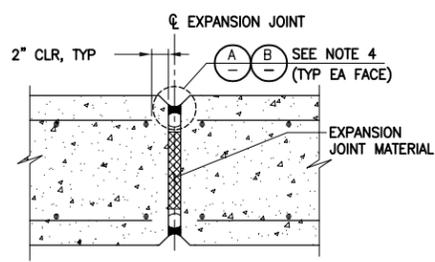
APPROVED:
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 DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

SUPERIOR METROPOLITAN DISTRICT NO. 1
 SUPERIOR, COLORADO
 ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

STRUCTURAL
 STANDARD DETAILS

DATE: 09/02/24
 PROJECT NUMBER: 50161727
 REVISION NO. A
 DRAWING NUMBER S-3

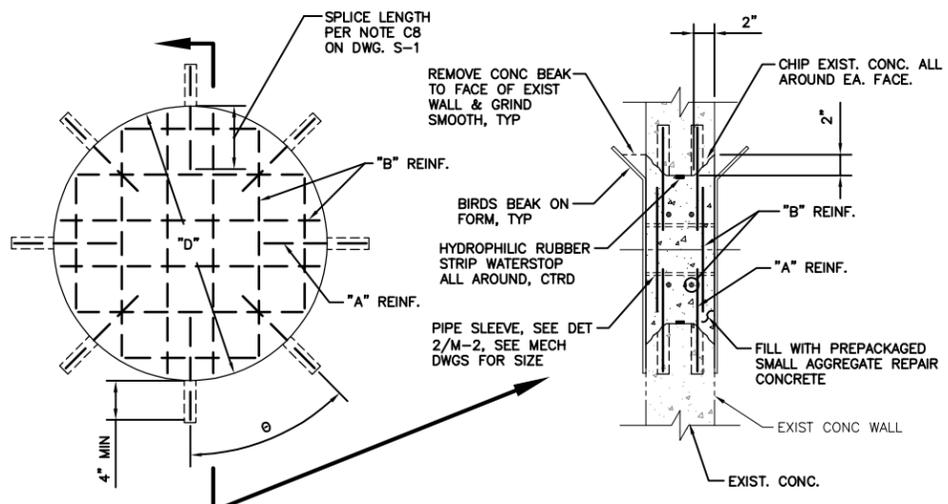
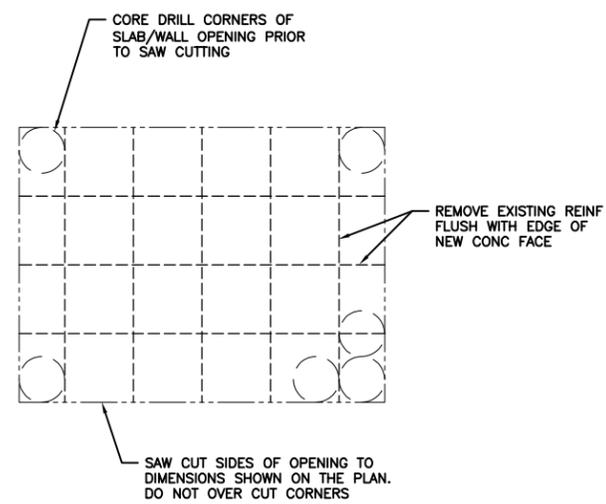


- NOTES:**
- 9" WATERSTOP WITH CENTER BULB CENTERED ON JOINT—SEE DETAIL 4/TYP. THOROUGHLY CLEAN WATERSTOP BEFORE PLACING CONCRETE IN SECOND POUR.
 - JOINT EDGES:
A. FOR WALLS AND BOTTOMS OF EXPOSED SLABS: FORM EDGES WITH 3/4" CHAMFER.
B. FOR SLABS: EDGE TOP AND ENDS WITH 1/4" RADIUS.
 - "W"=1" UNLESS OTHERWISE INDICATED ON PLANS. (MIN JOINT WIDTH = 3/8". MAX JOINT WIDTH = 2")

1 DETAIL EXPANSION JOINTS
NO SCALE

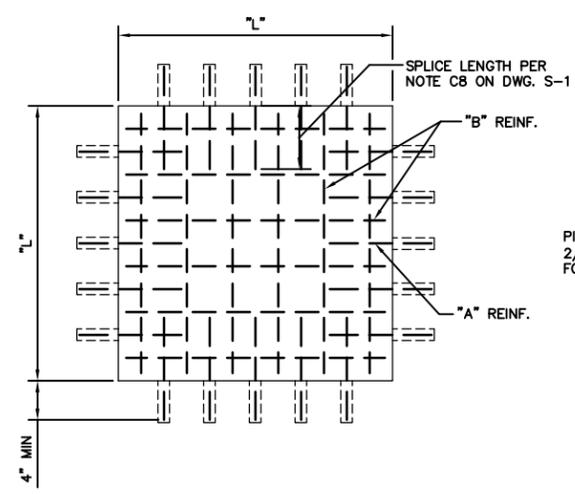
2 DETAIL EXPANSION JOINTS
NO SCALE

3 DETAIL SEALANT GROOVE
NO SCALE



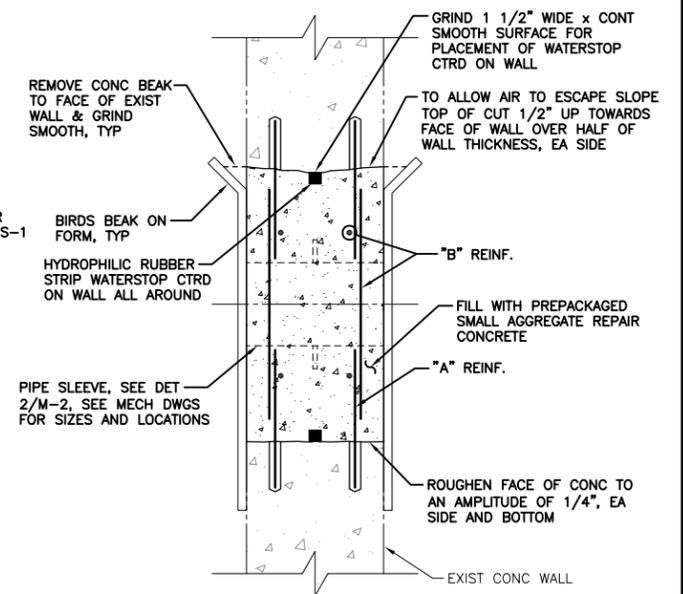
DIMENSION TABLE			
"D"	Ø	"A"	"B"
12" - 18"	60'	#5	#4 AT 12"
19" - 30"	45'	#5	#4 AT 12"
31" - 48"	30'	#6	#5 AT 12"
49" - 66"	15'	#6	#5 AT 12"

NOTE:
USE 2 LAYERS REINFORCING AT WALLS 12" OR MORE IN THICKNESS.



DIMENSION TABLE		
"L"	"A"	"B"
12" - 18"	#5 AT 12"	#4 AT 12"
19" - 30"	#5 AT 12"	#4 AT 12"
31" - 48"	#6 AT 12"	#5 AT 12"
49" - 66"	#6 AT 12"	#5 AT 12"

NOTE:
USE 2 LAYERS REINFORCING AT WALLS 12" OR MORE IN THICKNESS.



4 DETAIL EXISTING WALL/SLAB PENETRATION
NO SCALE

5 DETAIL CIRCULAR CONCRETE WALL PLUG
NO SCALE

6 DETAIL RECTANGULAR CONCRETE WALL PLUG
NO SCALE

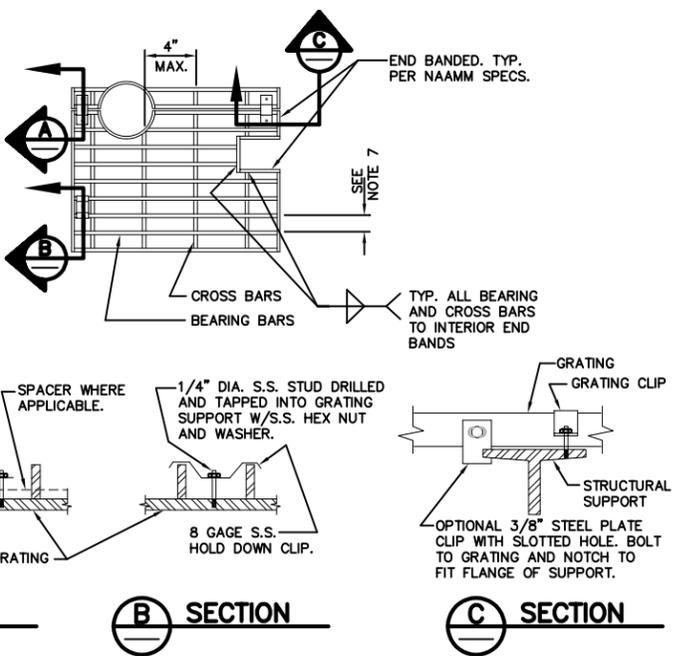
LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"=SCALE ACCORDINGLY)
DRAWING SPL61727-0004
DRAWN DS
DESIGNED MH
CHECKED MDS

APPROVED:
PRINCIPAL
DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

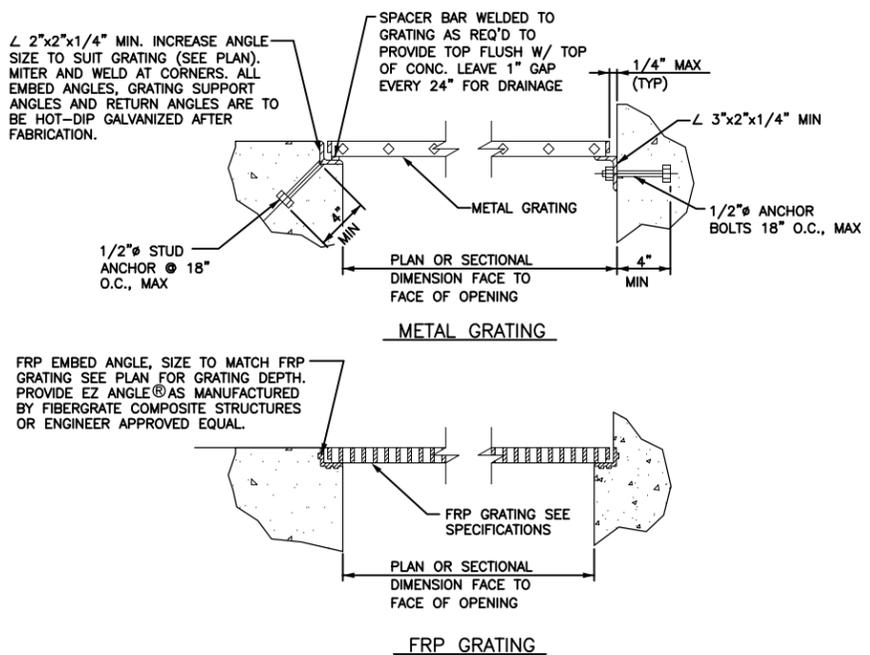
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER S-4
STRUCTURAL
STANDARD DETAILS



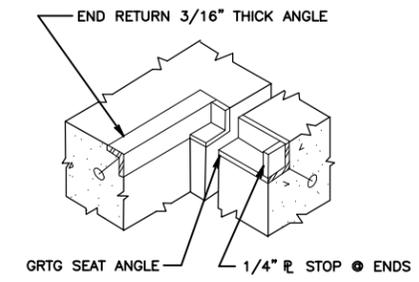
1 DETAIL
GRATING AND CONNECTION DETAILS
NO SCALE

- NOTES:**
1. GRATING SHALL CONFORM TO THE METAL BAR GRATING MANUAL OF NAAMM, UNLESS OTHERWISE SPECIFIED. GRATING SHALL BE ALUMINUM UNLESS NOTED OTHERWISE.
 2. GRATING SHALL BE SWAGED AND FORGED.
 3. WHERE BOLTED GRATING IS SPECIFIED, PROVIDE 4 GRATING CLIPS APPROX. 4" FROM THE CORNERS OF EACH PIECE. ADJACENT PIECES MAY BE ANCHORED WITH ONE CLIP AND 2 STUDS (SEE SECTION A).
 4. GRATING SHALL BE REMOVABLE.
 5. CLEAR SPAN SHALL BE PLAN DIMENSION FACE TO FACE OF OPENING.
 6. END BAND TO BE 1/4" LESS THAN GRATING DEPTH.
 7. GRATING DEPTH, MATERIAL, THICKNESS AND BEARING BAR SPACING SHALL BE AS SHOWN ON THE PLAN.

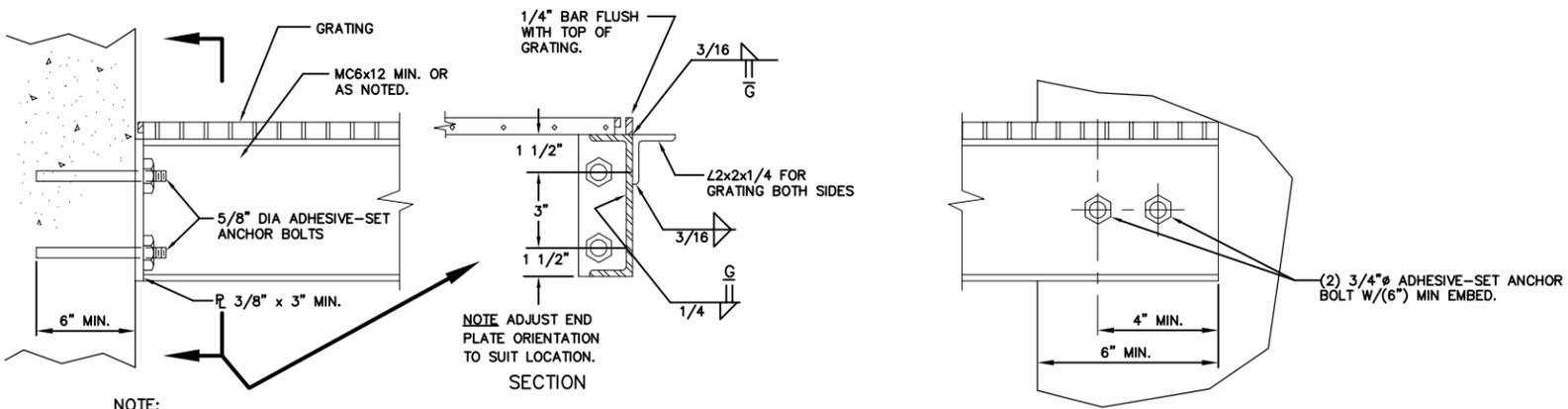
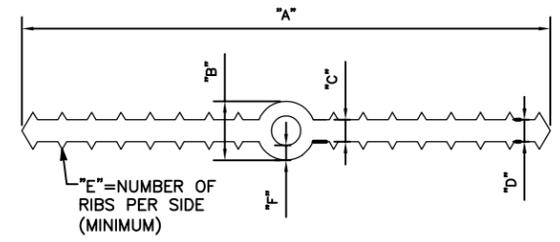


2 DETAIL
GRATING SUPPORT AT CONCRETE
NO SCALE

NOTE:
PROVIDE STAINLESS STEEL EMBED ANGLE AND ANCHORS WHERE INDICATED ON THE PLAN.



3 DETAIL
GRATING SUPPORT END RETURN
NO SCALE



4 DETAIL
GRATING END SUPPORT
NO SCALE

NOTE:
PROVIDE STAINLESS STEEL SUPPORTS WHERE INDICATED ON THE PLAN. ALL CARBON STEEL MEMBERS ARE TO BE HOT-DIP GALVANIZED AND COATED PER SPEC SECTION 09 90 00 AFTER FABRICATION.

TYPE	"A"	"B"	"C"	"D"	"E"	"F"	APPLICATION
W/O CENTER BULB	6"	-	3/8"	3/8"	7	-	CONSTRUCTION AND CONTROL JOINTS
CENTER BULB	9"	1"	3/8"	3/8"	7	1/4"	EXPANSION JOINTS 1" AND NARROWER

NOTES:
1. SEE SPECIFICATIONS FOR MATERIAL REQUIREMENTS.
2. DIMENSIONS ARE MINIMUM, UNLESS OTHERWISE NOTED.

5 DETAIL
PVC WATERSTOP
NO SCALE

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2" - SCALE ACCORDINGLY)
DRAWING SPL61727-0005
DRAWN DS
DESIGNED MH
CHECKED MDS

APPROVED:
PRINCIPAL
DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

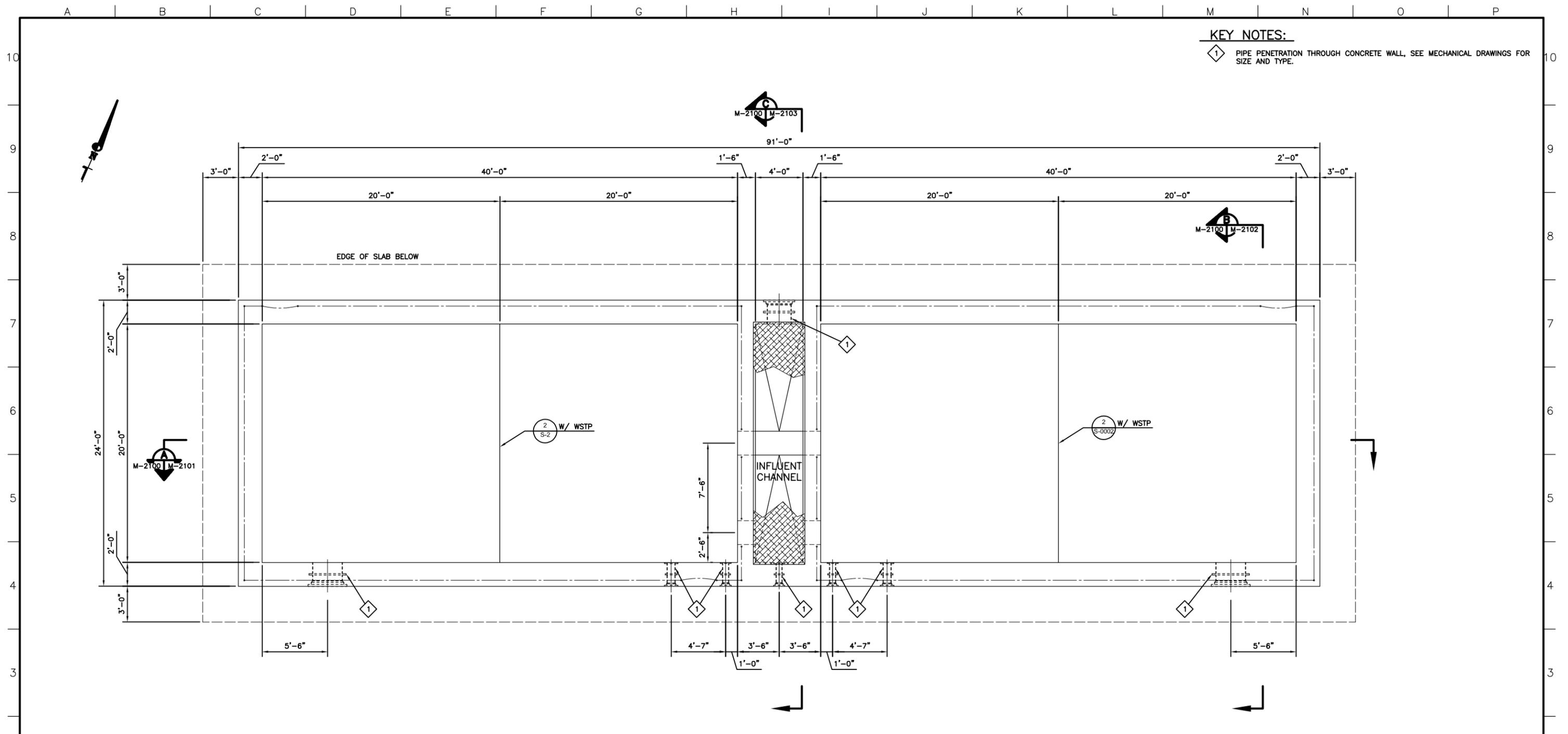
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

STRUCTURAL
STANDARD DETAILS

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER S-5

KEY NOTES:

1 PIPE PENETRATION THROUGH CONCRETE WALL, SEE MECHANICAL DRAWINGS FOR SIZE AND TYPE.



**PLAN
FOUNDATION**
SCALE: 1/4"=1'-0"

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES
AT FULL SIZE
(IF NOT 2"=SCALE ACCORDINGLY)
DRAWING SPL61727-2100
DRAWN DS
DESIGNED MH
CHECKED MDS

APPROVED:

PRINCIPAL
DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

**SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO**

**ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION**

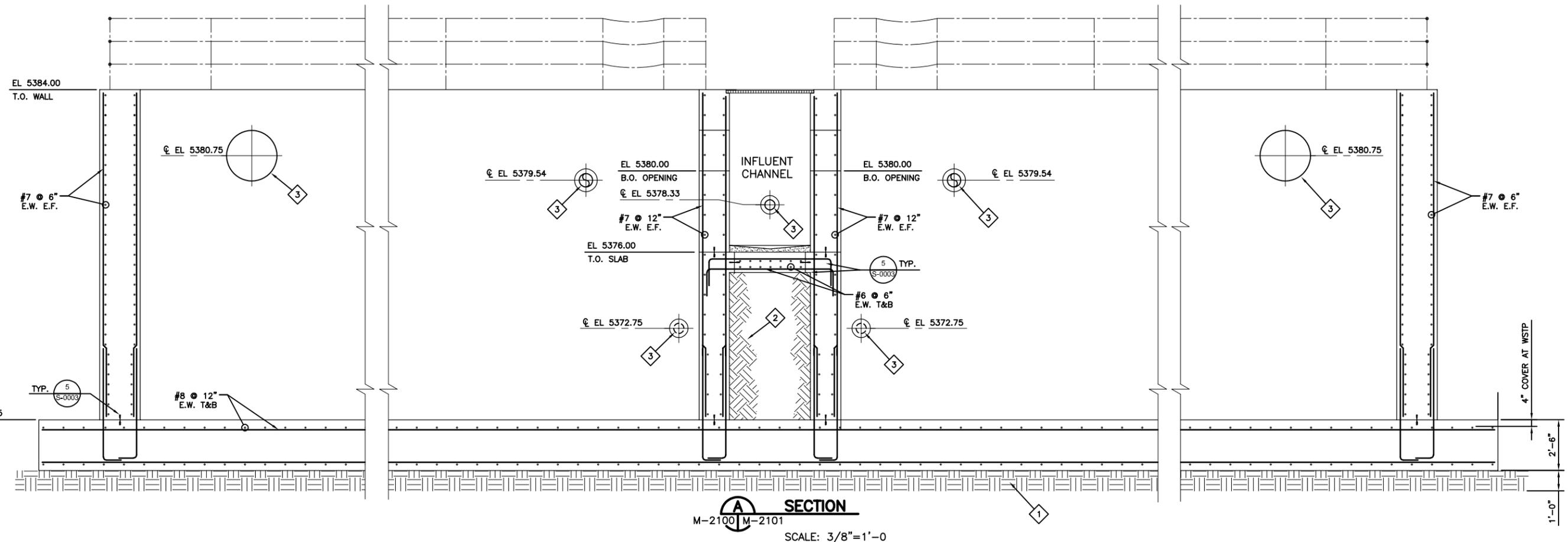
STRUCTURAL

**ANAEROBIC ZONE TRAINS 1 AND 2
PLAN**

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER
S-2100

KEY NOTES:

- 1 MOISTURE CONDITION BETWEEN OPTIMUM AND 3 PERCENTAGE POINTS ABOVE THE OPTIMUM MOISTURE CONTENT FOR CLAYEY SOILS AND WITHIN 2 PERCENTAGE POINTS OF THE OPTIMUM MOISTURE CONTENT FOR PREDOMINANTLY GRANULAR MATERIALS AND COMPACT TO A MINIMUM 98% RELATIVE COMPACTION PER ASTM S698.
- 2 COMPACTED SAND THAT FOLLOWS ASTM C-33.
- 3 PIPE PENETRATION THROUGH CONCRETE WALL, SEE MECHANICAL DRAWINGS FOR SIZE AND TYPE.



SECTION
M-2100 | M-2101
SCALE: 3/8"=1'-0"

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES
AT FULL SIZE
(IF NOT 2"=SCALE ACCORDINGLY)

DRAWING SPL61727-2101
DRAWN DS
DESIGNED MH
CHECKED MDS

APPROVED:

PRINCIPAL

DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

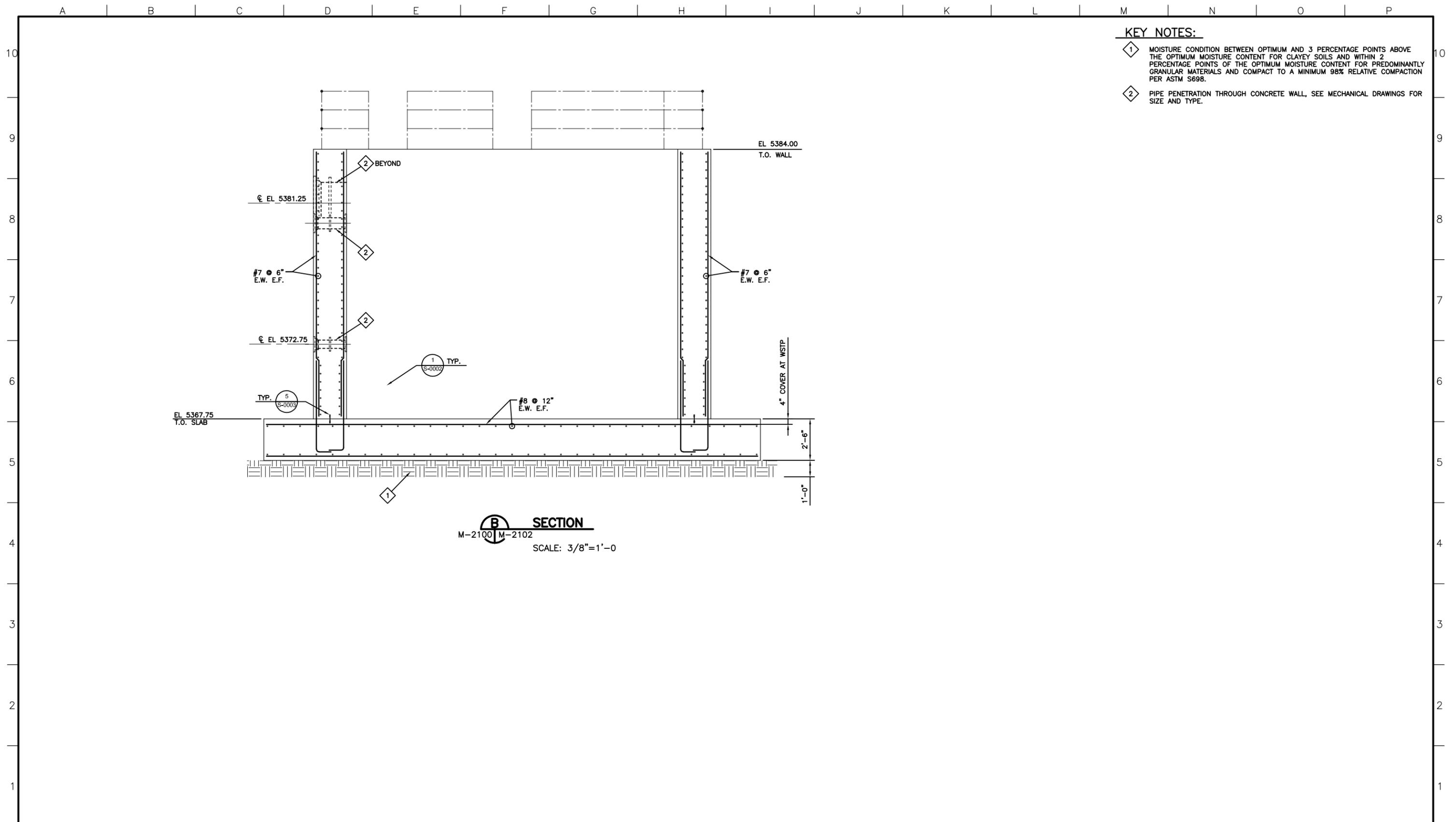
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

STRUCTURAL

ANAEROBIC ZONE TRAINS 1 AND 2
SECTION

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER
S-2101



- KEY NOTES:**
- ① MOISTURE CONDITION BETWEEN OPTIMUM AND 3 PERCENTAGE POINTS ABOVE THE OPTIMUM MOISTURE CONTENT FOR CLAYEY SOILS AND WITHIN 2 PERCENTAGE POINTS OF THE OPTIMUM MOISTURE CONTENT FOR PREDOMINANTLY GRANULAR MATERIALS AND COMPACT TO A MINIMUM 98% RELATIVE COMPACTION PER ASTM S698.
 - ② PIPE PENETRATION THROUGH CONCRETE WALL, SEE MECHANICAL DRAWINGS FOR SIZE AND TYPE.

SECTION
 M-2100 | M-2102
 SCALE: 3/8"=1'-0"

Dewberry
 Dewberry Engineers Inc.
 990 S. BROADWAY, SUITE 400
 Denver, Colorado 80209
 (303) 825-1802

LINE IS 2 INCHES
 AT FULL SIZE
 (IF NOT 2"=SCALE ACCORDINGLY)
 DRAWING SPL61727-2102
 DRAWN DS
 DESIGNED MH
 CHECKED MDS

APPROVED:

 PRINCIPAL
 DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

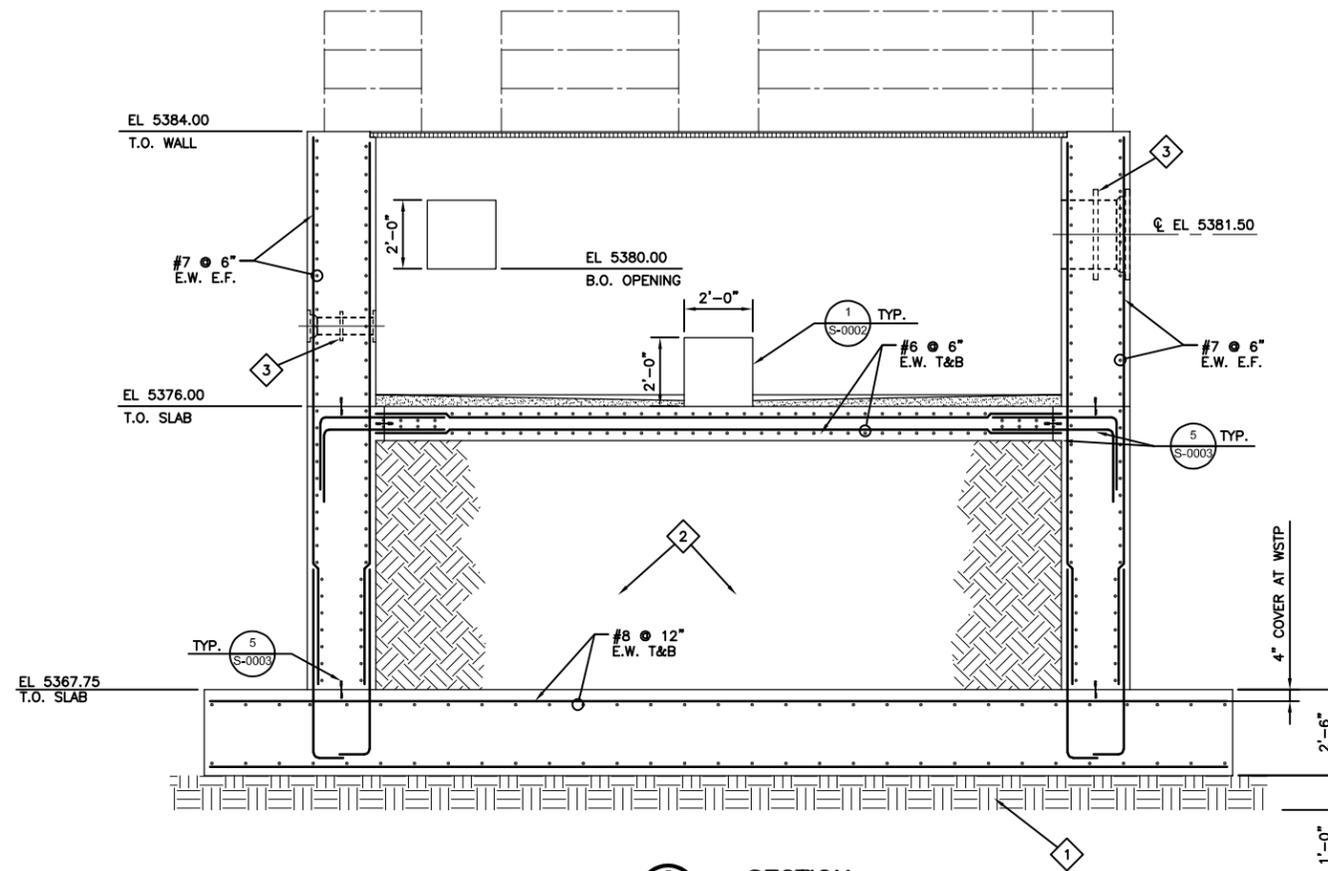
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
 ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

STRUCTURAL
 ANAEROBIC ZONE TRAINS 1 AND 2
 SECTION

DATE: 09/02/24
 PROJECT NUMBER: 50161727
 REVISION NO. A
 DRAWING NUMBER
S-2102

KEY NOTES:

- 1 MOISTURE CONDITION BETWEEN OPTIMUM AND 3 PERCENTAGE POINTS ABOVE THE OPTIMUM MOISTURE CONTENT FOR CLAYEY SOILS AND WITHIN 2 PERCENTAGE POINTS OF THE OPTIMUM MOISTURE CONTENT FOR PREDOMINANTLY GRANULAR MATERIALS AND COMPACT TO A MINIMUM 98% RELATIVE COMPACTION PER ASTM D698.
- 2 COMPACTED SAND THAT FOLLOWS ASTM C-33.
- 3 PIPE PENETRATION THROUGH CONCRETE WALL, SEE MECHANICAL DRAWINGS FOR SIZE AND TYPE.



C SECTION
M-2100 | M-2103
SCALE: 3/8"=1'-0"

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES
AT FULL SIZE
(IF NOT 2"=SCALE ACCORDINGLY)
DRAWING SPL61727-2103
DRAWN DS
DESIGNED MH
CHECKED MDS

APPROVED:

PRINCIPAL
DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	DS	09/05/24	MH

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

STRUCTURAL

ANAEROBIC ZONE TRAINS 1 AND 2
SECTION

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER
S-2103

TABLE A – MAXIMUM HORIZONTAL PIPE HANGER AND SUPPORT SPACING

NOMINAL PIPE SIZE (INCHES)	MAXIMUM PIPE SPAN (FEET) SEE NOTE 3			
	STEEL	COPPER	PLASTIC SEE NOTES 4, 9	DUCTILE/CAST IRON SEE NOTE 5
1/4 - 1	5	5	CONTINUOUS	12 FEET MAXIMUM SPACING FOR DUCTILE/CAST IRON PROCESS PIPING. SEE NOTE 7. 10 FEET MAXIMUM SPACING FOR CAST IRON SOIL PIPE (CISP). MINIMUM OF (1) HANGER PER PIPE SECTION WITHIN 4" OF JOINT ON THE PIPE BARREL. SEE ALSO NOTE 8. 8 FEET MAXIMUM SPACING FOR PIPE SIZES 12" AND LARGER. FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR MATERIAL AND SERVICE CONDITIONS.
1 - 1-1/2	5	5	5	
2 - 3	10	10	5	
4	10	12	5	
6	15	12	5	
8 - 10	15	15	5	
12	20	15	10	
14 - 18	20	---	---	
20 - 24	20	---	---	
30	30	---	---	

NOTES:

- DESIGN WEIGHT SHALL BE TWICE THE WEIGHT OF THE PIPE FULL OF WATER PLUS THE WEIGHTS OF VALVES, FITTINGS, INSULATING MATERIALS AND SUSPENDED HANGER COMPONENTS ON THE RUN OF PIPE BEING SUPPORTED.
- WHERE PIPING IS CONNECTED TO EQUIPMENT, A VALVE, PIPING ASSEMBLY, ETC., THAT WILL REQUIRE REMOVAL FOR MAINTENANCE, THE PIPING SHALL BE SUPPORTED IN SUCH A MANNER THAT TEMPORARY SUPPORTS SHALL NOT BE NECESSARY FOR THIS PROCEDURE.
- PIPE SHALL NOT HAVE POCKETS FORMED IN THE SPAN DUE TO SAGGING OF THE PIPE BETWEEN SUPPORTS CAUSED BY THE WEIGHT OF THE PIPE, MEDIUM IN THE PIPE, INSULATION, VALVES AND FITTINGS.
- SPAN SHOWN IS FOR SCHEDULE 80 PVC PIPE AT 100° F. SPANS FOR OTHER PLASTICS, OTHER PVC PIPE SCHEDULES AND PIPES AT HIGHER TEMPERATURES SHALL BE SHORTENED IN ACCORDANCE WITH THE PIPE MANUFACTURER'S RECOMMENDATIONS. "CONTINUOUS" MEANS PIPE SHALL BE IN UNISTRUT OR SIMILAR CHANNEL.
- PIPE HANGER AND SUPPORT SELECTION SHALL BE IN ACCORDANCE WITH TABLE C AND SPECIFICATION SECTION 33 14 13.
- THE CONTRACTOR SHALL LOCATE HANGERS AND SUPPORTS AS NEAR AS POSSIBLE TO CONCENTRATED LOADS SUCH AS VALVES, FLANGES, ETC. LOCATE HANGERS, SUPPORTS AND ACCESSORIES WITHIN THE MAXIMUM SPAN LENGTHS SPECIFIED IN THE PROJECT MANUAL TO SUPPORT CONTINUOUS PIPELINE RUNS UNAFFECTED BY CONCENTRATED LOADS.
- AT LEAST ONE HANGER OR SUPPORT SHALL BE LOCATED WITHIN 2 FEET FROM A PIPE CHANGE IN DIRECTION OR BRANCH.
- THE CONTRACTOR SHALL LOCATE HANGERS AND SUPPORTS TO ENSURE THAT CONNECTIONS TO EQUIPMENT, TANKS, ETC, ARE SUBSTANTIALLY FREE FROM LOADS TRANSMITTED BY THE PIPING.
- ON PLASTIC PRESSURE PIPING SYSTEMS HANGERS SHALL BE PROVIDED WITH PADS OR CUSHIONS ON THE BEARING SURFACES TO PREVENT SCRATCHING THE PIPE. THE HANGERS SHALL FIT LOOSELY AROUND PIPE YET CONTACT IT THROUGH THE PADS OR CUSHIONS IN A MANNER TO DISTRIBUTE THE LOAD OVER THE LARGEST POSSIBLE AREA. POINT LOADINGS SHALL BE AVOIDED. THE SYSTEM HANGERS SHALL BE DESIGNED WITH THE LEAST PRACTICAL NUMBER OF RIGID ANCHOR POINTS. SUPPORTS FOR VERTICAL PIPING AND ALL ANCHORS SHALL BE AS RECOMMENDED BY THE PIPE MANUFACTURER.

TABLE B – MINIMUM ROD DIAMETER FOR SINGLE RIGID ROD HANGERS

NOMINAL PIPE SIZE (INCHES)	SUPPORT ROD SIZE AND MAXIMUM LOAD PER ROD. SEE NOTE 2	
	INCHES	POUNDS
1/4 - 2	3/8	610
2-1/2 - 3-1/2	1/2	1130
4 - 5	5/8	1810
6 - 8	3/4	2710
10 - 12	7/8	3770
14 - 18	1	4960
20 - 30	1-1/4	8000

NOTES:

- DESIGN WEIGHT SHALL BE TWICE THE WEIGHT OF THE PIPE FULL OF WATER PLUS THE WEIGHTS OF VALVES, FITTINGS, INSULATING MATERIALS AND SUSPENDED HANGER COMPONENTS ON THE RUN OF PIPE BEING SUPPORTED.
- ROD SIZES SHOWN ARE FOR THE SUPPORT OF A SINGLE PIPE. WHEN SUPPORTING MORE THAN ONE PIPE, ROD SHALL BE SIZED USING DESIGN WEIGHTS (SEE NOTE 1) TO DETERMINE THE TOTAL DESIGN LOAD. THE TOTAL DESIGN LOAD SHALL NOT EXCEED THE MAXIMUM LOADS IN THE TABLE ABOVE.
- RODS MAY BE REDUCED ONE SIZE FOR DOUBLE ROD HANGERS. MINIMUM ROD DIAMETER SHALL BE 3/8".

TABLE C HANGER AND SUPPORT SELECTIONS

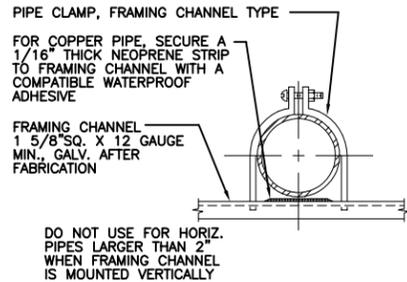
SYSTEM	INSULATION	PIPE ATTACHMENTS										BUILDING STRUCTURAL ATTACHMENTS			
		NOTE 1	HORIZONTAL								VERTICAL	STEEL AND/OR MALL. IRON			
			STEEL STRAPS	STEEL BANDS	STEEL CLAMPS	CAST IRON HANGING ROLLS	CAST IRON SUPPORTING ROLLS	STEEL TRAPEZES AND RACKS	THERMAL HANGER SHIELDS	STEEL OR CAST IRON STANCHIONS		STEEL RISER CLAMPS	INSERTS	BEAM CLAMPS	WELDED & BOLTED ATTACHMENTS
HOT 120 TO 450	COVERED	8, 13	1	3	4, 5	9	1, 2, 3/M-3	SEE SPEC 22 07 00	10, 11	12, 13	A	C, D	F, M	B, G, H, K, L	
AMBIENT 60 TO 119	COVERED	8, 13	1	3	4, 5	9	1, 2, 3/M-3	SEE SPEC 22 07 00	10, 11	12, 13	A	C, D	F, M	B, G, H, K, L	
	BARE	6, 7, 8, 13	1	3	4, 5	9	1, 2, 3/M-3	NONE	10, 11						
COLD 33 TO 59	COVERED	8, 13	1	3	4, 5	9	1, 2, 3/M-3	SEE SPEC 22 07 00	10, 11	12, 13	A	C, D	F, M	B, G, H, K, L	
	BARE	6, 7, 8, 13	1	3	4, 5	9	1, 2, 3/M-3	NONE	10, 11	12, 13	A	C, D	F, M	B, G, H, K, L	
COLD 19 TO 32	COVERED	NONE	1	NONE	4, 5	9	1, 2, 3/M-3	SEE SPEC 22 07 00	10, 11	12, 13	A	C, D	F, M	B, G, H, K, L	
	BARE	NONE	1	3	4, 5	9	1, 2, 3/M-3	NONE	10, 11	12, 13	A	C, D	F, M	B, G, H, K, L	

NOTES:

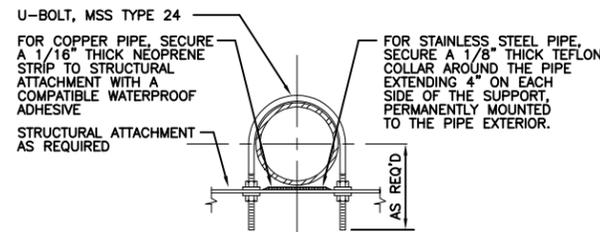
- HANGERS ON INSULATED SYSTEMS SHALL INCORPORATE PROTECTION SADDLES AND SHIELDS. SEE SPECIFICATION 22 07 00.
- HANGER AND SUPPORT SPACING SHALL BE IN ACCORDANCE WITH TABLE A.
- FOR SHIELDS USED WITH ROLLERS OR SUBJECT TO POINT LOADING ON INSULATED PIPING SYSTEMS, SEE SPECIFICATIONS.
- CONTINUOUS INSERTS, EMBEDDED PLATES, ANCHOR BOLTS AND CONCRETE FASTENERS MAY BE USED AS SPECIFIED BY THE ENGINEER.
- ON INSERT TYPE BUILDING STRUCTURAL ATTACHMENTS, THE NEED TO MAINTAIN A VAPOR BARRIER MAY BE REQUIRED BECAUSE OF AMBIENT DEW POINT CONSIDERATIONS.

GENERAL NOTES:

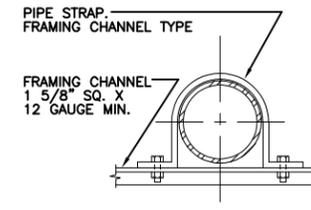
- WHERE NO REFERENCE TO PIPE SUPPORT SYSTEMS ARE GIVEN ON THE DRAWINGS, THE CONTRACTOR SHALL USE AN APPROPRIATE SYSTEM. SEE TABLE "C" DRAWING M-1. PIPE AND CONDUIT SUPPORT SYSTEMS SHALL BE UNISTRUT, B-LINE, OR EQUAL, AND SHALL BE DESIGNED BY THE CONTRACTOR TO MEET THE MINIMUM LOAD AND SPAN REQUIREMENTS AS SPECIFIED. CONTRACTOR SHALL SUBMIT PIPE SUPPORT SYSTEM DESIGN TO ENGINEER FOR APPROVAL PRIOR TO FABRICATION.
- ALL HANGERS AND SUPPORTS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. NUTS, BOLTS AND WASHERS MAY BE ZINC PLATED. THOSE SUBJECT TO MOISTURE OR CORROSIVE ATMOSPHERE SHALL BE EPOXY COATED PRIOR TO INSTALLATION.
- EXPANSION ANCHORS SHALL NOT BE USED, UNLESS OTHERWISE SPECIFIED.
- MSS REFERS TO THE MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY, STANDARD PRACTICE SP58 AND SP69.
- HANGER BRACKETS AND SUPPORT COMPONENTS MAY BE INTERCHANGED.
- CONCRETE INSERTS IN AREAS BELOW WATER SURFACE OR NORMALLY SUBJECT TO SUBMERGING SHALL BE EMBEDDED ANCHOR BOLTS OR EQUAL.
- PROVIDE PLASTIC OR RUBBER CHANNEL END CAPS AT EXPOSED ENDS OF CHANNELS 7'-0" ABOVE FLOOR OR LOWER.
- MAXIMUM DESIGN WEIGHTS AND LOADS SHALL BE AS SHOWN IN TABLE "A" DRAWING M-1, OR AS NOTED ON DETAILS.
- WHERE MULTIPLE PIPE RUNS OCCUR IN CLOSE PROXIMITY TO EACH OTHER TRAPEZE RACKS SHALL BE USED UNLESS NOTED OTHERWISE.
- ALL PIPING SUPPORTED BY HANGERS AND/OR STRUCTURAL ATTACHMENTS SHALL BE BRACED AGAINST HORIZONTAL, VERTICAL, AXIAL, AND LONGITUDINAL SWAY. BRACINGS SHALL BE CALCULATED TO RESIST SEISMIC LOADINGS AS SPECIFIED.
- FITTINGS SHALL NOT BE LESS THAN MSS CL B.
- TRAPEZE AND PIPE RACK COMPONENTS SHALL HAVE A MINIMUM STEEL THICKNESS OF 12 GAGE WITH A MAXIMUM DEFLECTION 1/240 OF THE SPAN, UNLESS OTHERWISE SPECIFIED. MINIMUM CHANNEL COMPONENT SIZE SHALL BE 1 5/8" SQUARE AS MANUFACTURED BY SUPER STRUT, UNISTRUT, B-LINE, OR EQUAL.
- ALL CONNECTIONS OF PIPE SUPPORT COMPONENTS SHALL BE BOLTED.
- ALL PIPE SUPPORTS SHALL BE ATTACHED TO STRUCTURAL FRAMING OR LOAD BEARING BUILDING ELEMENTS. PIPE SHALL NOT BE SUPPORTED FROM OTHER PIPING SYSTEMS.
- NOT ALL PIPING SERVICE TYPES LISTED IN STANDARD DETAILS MAY BE APPLICABLE TO THIS PROJECT.



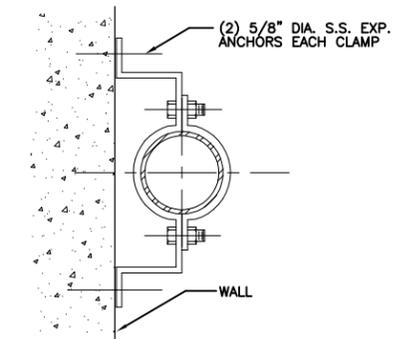
TYPE 6 – FRAMING CHANNEL PIPE CLAMP
3/8" THROUGH 8" PIPE



TYPE 7 – U-BOLT
1/2" THROUGH 20" PIPE



TYPE 8 – FRAMING CHANNEL PIPE STRAP
1/2" THROUGH 6" PIPE



TYPE 12 – OFFSET PIPE CLAMP
3/4" THROUGH 8" PIPE

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LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)
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DRAWN STD
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CHECKED PDR

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REV.	DESCRIPTION	BY	DATE	APP.
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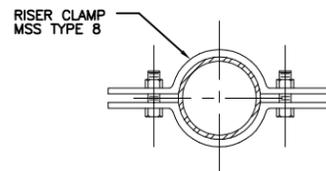
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

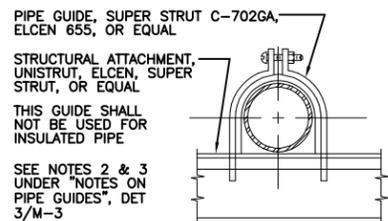
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STANDARD DETAILS

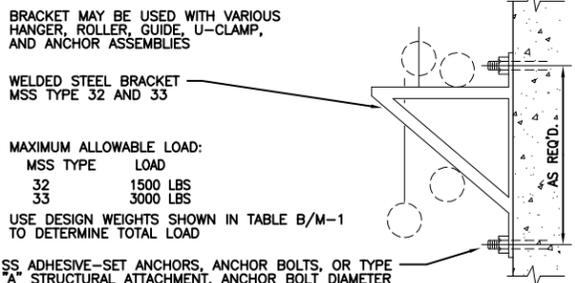
DATE: 09/01/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER M-1



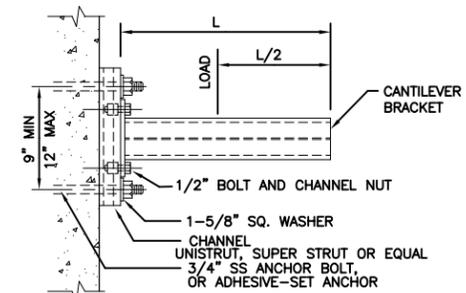
TYPE 13 - RISER CLAMP
1/2" THROUGH 12" PIPE



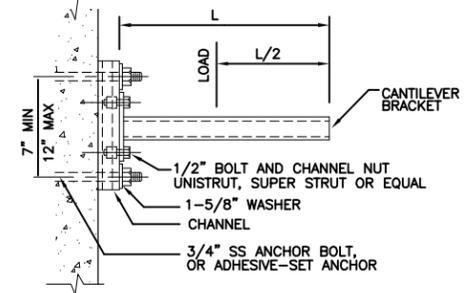
TYPE 16 PIPE GUIDE
1/2" THROUGH 6" PIPE



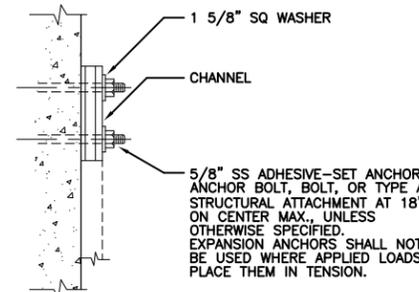
**TYPE G
WELDED STEEL BRACKET**



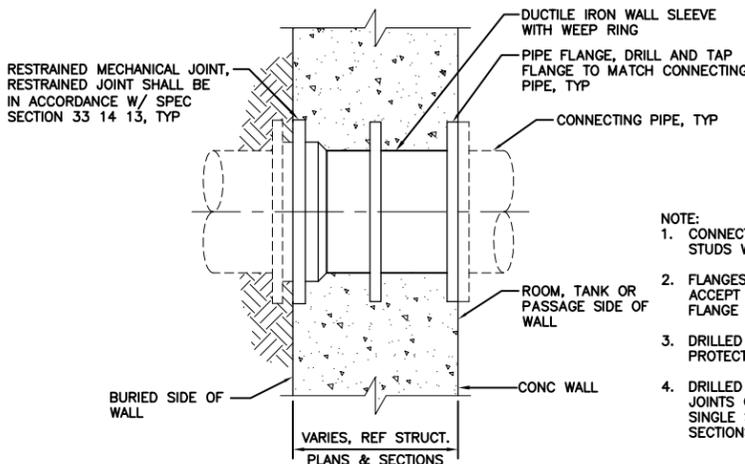
**TYPE K
DOUBLE CHANNEL BRACKET**



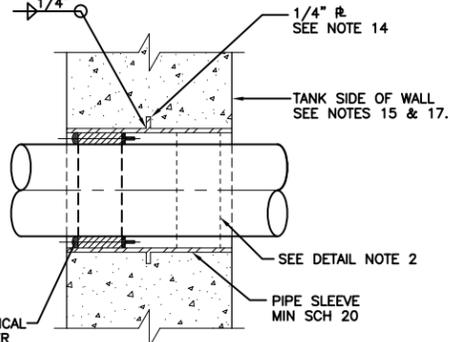
**TYPE L
SINGLE CHANNEL BRACKET**



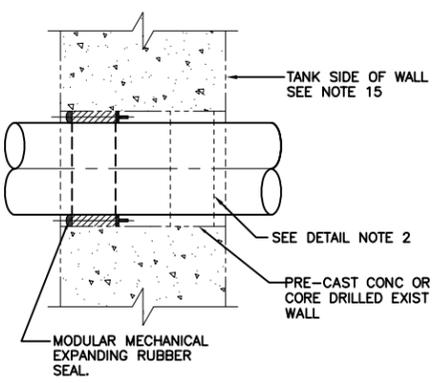
**TYPE M
WALL MOUNTED CHANNEL**



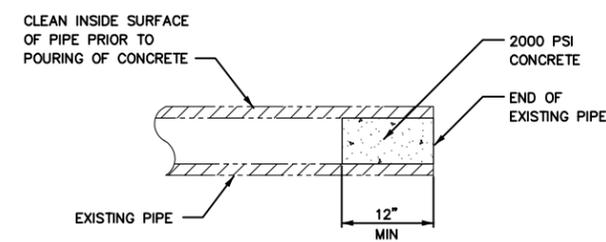
**1 DETAIL
PIPE PENETRATION (WALLS & SLABS)**
NO SCALE



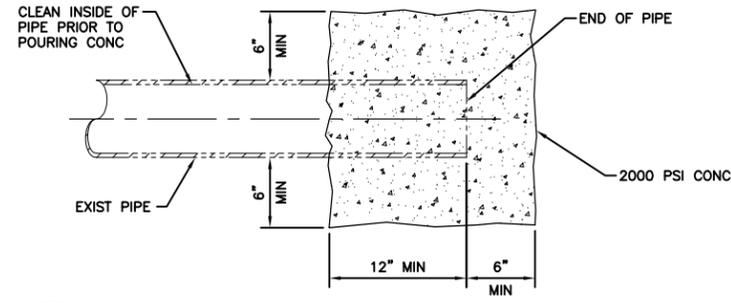
**2 DETAIL
PIPE PENETRATION (WALLS)**
TYPE D



**3 DETAIL
PIPE PENETRATION (EXIST OR PRE-CAST WALLS)**
NO SCALE



**4 DETAIL
EXISTING PIPE PLUG, 12" AND SMALLER**
NO SCALE



**5 DETAIL
EXISTING PIPE PLUG, LARGER THAN 12"**
NO SCALE

- PIPE PENETRATION NOTES:**
- WHERE PIPES PASS THROUGH WALLS, FLOORS, OR CEILINGS, PENETRATIONS SHALL CONFORM TO TABLE, EXCEPT AS OTHERWISE SPECIFIED
 - IN TABLE, "TANK" SHALL MEAN ANY PART OF A STRUCTURE CONTAINING LIQUID, OR IN CONTACT WITH THE EARTH.
 - IN TABLE, "PASSAGE" SHALL MEAN ROOM, GALLERY, TUNNEL OR SIMILAR ENCLOSURE.
 - IN TABLE, WATER SURFACE, "WS" SHALL MEAN AN ELEVATION 9 INCHES ABOVE MAXIMUM WATER SURFACE SHOWN.
 - ALL STEEL SLEEVES SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION
 - IN CONDITION 5, TYPE A OR C SHALL BE USED WHERE ONE SIDE CONTAINS EXPLOSION PROOF EQUIPMENT, WHERE FLOODING IS POSSIBLE, OR WHERE EQUIPMENT.
 - SEAL FLANGES SHALL BE DRILLED TO 150 POUND STANDARD, EACH JOINT SHALL BE GASKETED.
 - WHERE SPECIFIED, CAST IRON FLANGES MAY BE INSTALLED FLUSH WITH WALL AND TAPPED FOR STUDS
 - PROVIDE CURB WHERE PENETRATING FLOOR, EXCEPT FOR PENETRATION TYPES E AND F. CURB SHALL BE 4" HIGH BY 4" WIDE.
 - PROVIDE A MINIMUM OF 3" CLEARANCE BETWEEN REINFORCING STEEL AND FERROUS METAL PENETRATIONS.
 - FLEXIBLE JOINTS SHALL BE PROVIDED FOR UNDERGROUND PIPING AS SPECIFIED.
 - SEE SPECIFICATION SECTION 33 14 13 FOR RESTRAINED FLEXIBLE COUPLING DESIGN REQUIREMENTS.
 - INSULATION SHALL NOT EXTEND THROUGH SLEEVES, UNLESS OTHERWISE SPECIFIED.
 - WEEP RINGS SHALL HAVE MINIMUM DIAMETER EQUAL TO PIPE DIAMETER PLUS 3 INCHES.
 - TANK SIDE OF WALL SHALL MEAN SIDE OF WALL NORMALLY EXPOSED TO LIQUID.
 - SEAL WITH MASTIC SEALANT WHERE WALL IS EXPOSED TO LIQUID, EARTH, OR AN EXPLOSION HAZARD AREA.
 - FOR EXISTING WALL PENETRATIONS UP TO 18" PIPE DIAMETER, CORE DRILL WALL AND OMIT WALL SLEEVE. CORE DIAMETER SHALL BE AS RECOMMENDED BY THE SEAL MANUFACTURER.
 - WHERE CAST IRON PIPE IS EMBEDDED IN CONCRETE AT AN EXPANSION JOINT USE DETAIL 1/M-5.

PIPE PENETRATION TYPES					
	CONDITION	FROM	TO	TYPE	
				STEEL PIPE	CAST OR DUCTILE IRON
1.	TANK	TANK BELOW W.S.	A, C, D OR F	C, D OR F	D
2.	TANK	TANK ABOVE W.S.	D	D	D
3.	PASSAGE	TANK BELOW W.S.	A, C, D OR F	A, C, D OR F	D
4.	PASSAGE	TANK ABOVE W.S.	C, D, G OR H	C, D, G OR H	C, D OR G
5.	PASSAGE	PASSAGE	E OR H SEE NOTE 6	E OR H SEE NOTE 6	E OR H SEE NOTE 6
6.	PASSAGE	OUTSIDE WALL	C OR D	C OR D	C OR D
7.	PASSAGE	ROOF	AS SHOWN		
8.	TANK	OUTSIDE WALL	C OR D	C OR D	C OR D

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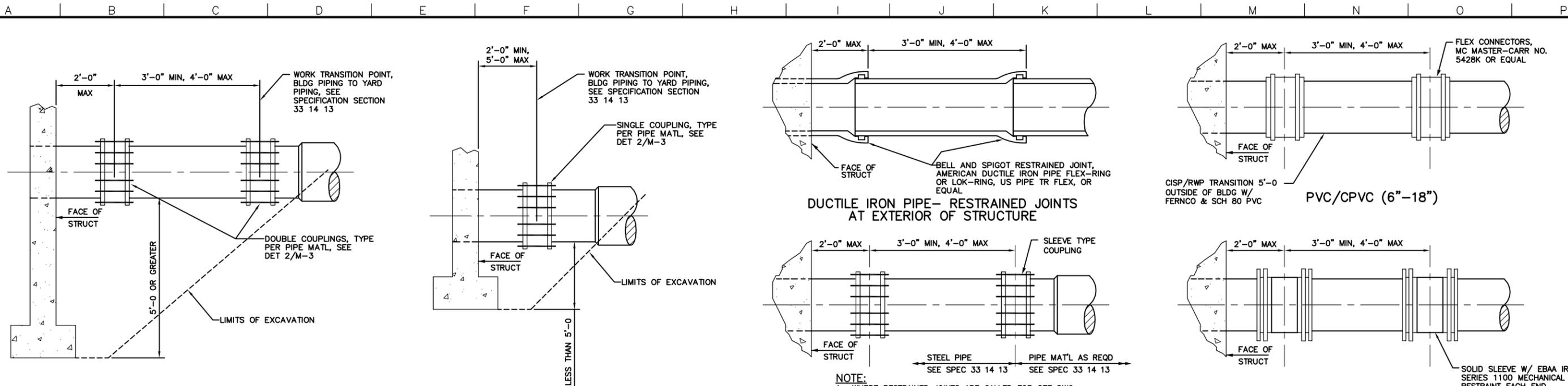
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SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

MECHANICAL
STANDARD DETAILS
DATE: 09/01/24
PROJECT NUMBER: 50161727
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DRAWING NUMBER M-2



1 DETAIL BURIED PIPE AT STRUCTURES
NO SCALE

2 DETAIL BURIED PIPE COUPLINGS AT STRUCTURES
NO SCALE

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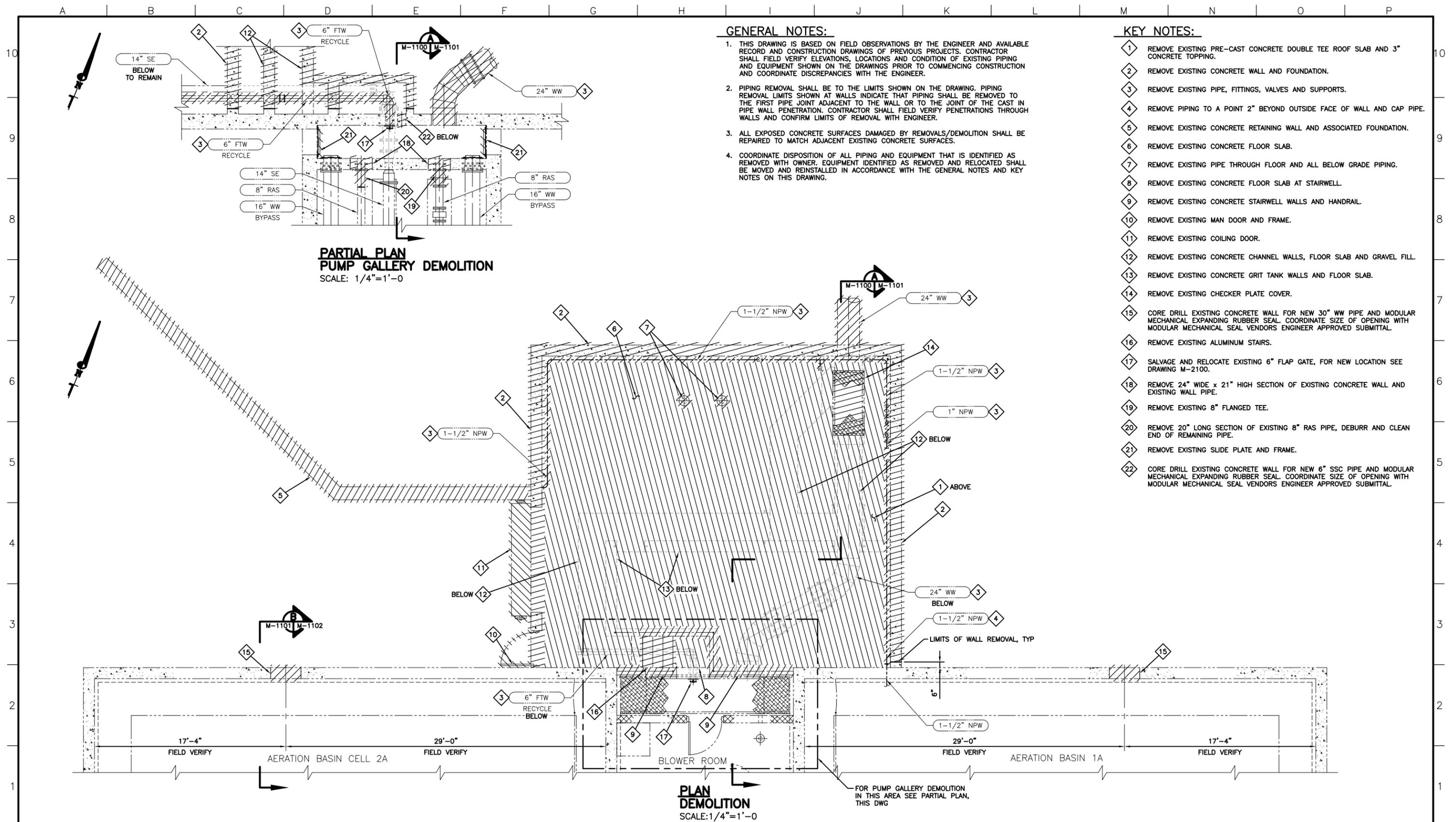
SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

MECHANICAL

STANDARD DETAILS

DATE: 09/01/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER M-3



GENERAL NOTES:

1. THIS DRAWING IS BASED ON FIELD OBSERVATIONS BY THE ENGINEER AND AVAILABLE RECORD AND CONSTRUCTION DRAWINGS OF PREVIOUS PROJECTS. CONTRACTOR SHALL FIELD VERIFY ELEVATIONS, LOCATIONS AND CONDITION OF EXISTING PIPING AND EQUIPMENT SHOWN ON THE DRAWINGS PRIOR TO COMMENCING CONSTRUCTION AND COORDINATE DISCREPANCIES WITH THE ENGINEER.
2. PIPING REMOVAL SHALL BE TO THE LIMITS SHOWN ON THE DRAWING. PIPING REMOVAL LIMITS SHOWN AT WALLS INDICATE THAT PIPING SHALL BE REMOVED TO THE FIRST PIPE JOINT ADJACENT TO THE WALL OR TO THE JOINT OF THE CAST IN PIPE WALL PENETRATION. CONTRACTOR SHALL FIELD VERIFY PENETRATIONS THROUGH WALLS AND CONFIRM LIMITS OF REMOVAL WITH ENGINEER.
3. ALL EXPOSED CONCRETE SURFACES DAMAGED BY REMOVALS/DEMOLITION SHALL BE REPAIRED TO MATCH ADJACENT EXISTING CONCRETE SURFACES.
4. COORDINATE DISPOSITION OF ALL PIPING AND EQUIPMENT THAT IS IDENTIFIED AS REMOVED WITH OWNER. EQUIPMENT IDENTIFIED AS REMOVED AND RELOCATED SHALL BE MOVED AND REINSTALLED IN ACCORDANCE WITH THE GENERAL NOTES AND KEY NOTES ON THIS DRAWING.

KEY NOTES:

- 1 REMOVE EXISTING PRE-CAST CONCRETE DOUBLE TEE ROOF SLAB AND 3" CONCRETE TOPPING.
- 2 REMOVE EXISTING CONCRETE WALL AND FOUNDATION.
- 3 REMOVE EXISTING PIPE, FITTINGS, VALVES AND SUPPORTS.
- 4 REMOVE PIPING TO A POINT 2" BEYOND OUTSIDE FACE OF WALL AND CAP PIPE.
- 5 REMOVE EXISTING CONCRETE RETAINING WALL AND ASSOCIATED FOUNDATION.
- 6 REMOVE EXISTING CONCRETE FLOOR SLAB.
- 7 REMOVE EXISTING PIPE THROUGH FLOOR AND ALL BELOW GRADE PIPING.
- 8 REMOVE EXISTING CONCRETE FLOOR SLAB AT STAIRWELL.
- 9 REMOVE EXISTING CONCRETE STAIRWELL WALLS AND HANDRAIL.
- 10 REMOVE EXISTING MAN DOOR AND FRAME.
- 11 REMOVE EXISTING COILING DOOR.
- 12 REMOVE EXISTING CONCRETE CHANNEL WALLS, FLOOR SLAB AND GRAVEL FILL.
- 13 REMOVE EXISTING CONCRETE GRIT TANK WALLS AND FLOOR SLAB.
- 14 REMOVE EXISTING CHECKER PLATE COVER.
- 15 CORE DRILL EXISTING CONCRETE WALL FOR NEW 30" WW PIPE AND MODULAR MECHANICAL EXPANDING RUBBER SEAL. COORDINATE SIZE OF OPENING WITH MODULAR MECHANICAL SEAL VENDORS ENGINEER APPROVED SUBMITTAL.
- 16 REMOVE EXISTING ALUMINUM STAIRS.
- 17 SALVAGE AND RELOCATE EXISTING 6" FLAP GATE, FOR NEW LOCATION SEE DRAWING M-2100.
- 18 REMOVE 24" WIDE x 21" HIGH SECTION OF EXISTING CONCRETE WALL AND EXISTING WALL PIPE.
- 19 REMOVE EXISTING 8" FLANGED TEE.
- 20 REMOVE 20" LONG SECTION OF EXISTING 8" RAS PIPE, DEBURR AND CLEAN END OF REMAINING PIPE.
- 21 REMOVE EXISTING SLIDE PLATE AND FRAME.
- 22 CORE DRILL EXISTING CONCRETE WALL FOR NEW 6" SSC PIPE AND MODULAR MECHANICAL EXPANDING RUBBER SEAL. COORDINATE SIZE OF OPENING WITH MODULAR MECHANICAL SEAL VENDORS ENGINEER APPROVED SUBMITTAL.

PARTIAL PLAN PUMP GALLERY DEMOLITION
SCALE: 1/4"=1'-0

PLAN DEMOLITION
SCALE: 1/4"=1'-0

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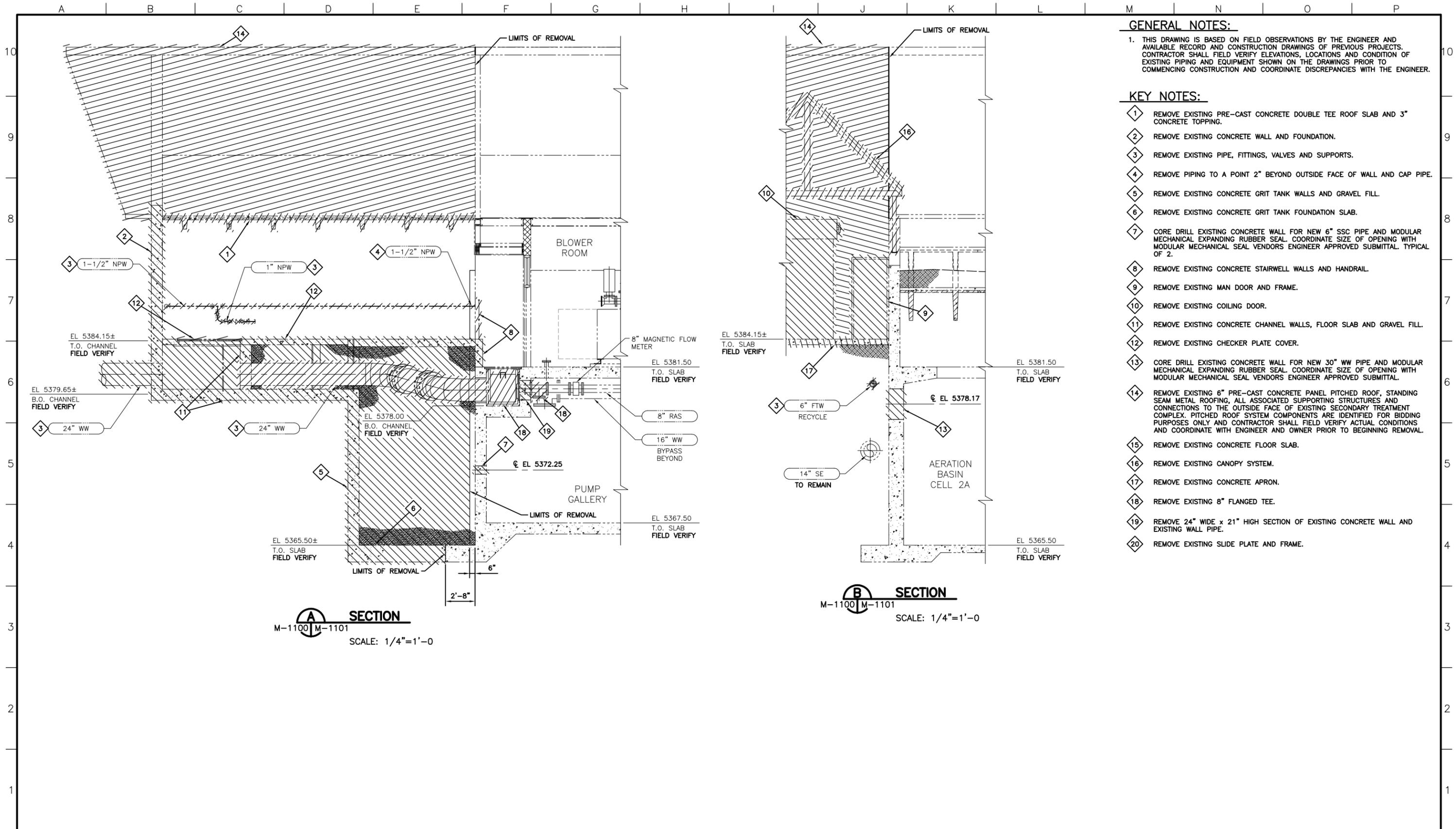
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SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

MECHANICAL
EXISTING SECONDARY TREATMENT COMPLEX
DEMOLITION PLANS

DATE: 08/28/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER
M-1100



GENERAL NOTES:
 1. THIS DRAWING IS BASED ON FIELD OBSERVATIONS BY THE ENGINEER AND AVAILABLE RECORD AND CONSTRUCTION DRAWINGS OF PREVIOUS PROJECTS. CONTRACTOR SHALL FIELD VERIFY ELEVATIONS, LOCATIONS AND CONDITION OF EXISTING PIPING AND EQUIPMENT SHOWN ON THE DRAWINGS PRIOR TO COMMENCING CONSTRUCTION AND COORDINATE DISCREPANCIES WITH THE ENGINEER.

- KEY NOTES:**
- 1 REMOVE EXISTING PRE-CAST CONCRETE DOUBLE TEE ROOF SLAB AND 3" CONCRETE TOPPING.
 - 2 REMOVE EXISTING CONCRETE WALL AND FOUNDATION.
 - 3 REMOVE EXISTING PIPE, FITTINGS, VALVES AND SUPPORTS.
 - 4 REMOVE PIPING TO A POINT 2" BEYOND OUTSIDE FACE OF WALL AND CAP PIPE.
 - 5 REMOVE EXISTING CONCRETE GRIT TANK WALLS AND GRAVEL FILL.
 - 6 REMOVE EXISTING CONCRETE GRIT TANK FOUNDATION SLAB.
 - 7 CORE DRILL EXISTING CONCRETE WALL FOR NEW 6" SSC PIPE AND MODULAR MECHANICAL EXPANDING RUBBER SEAL. COORDINATE SIZE OF OPENING WITH MODULAR MECHANICAL SEAL VENDORS ENGINEER APPROVED SUBMITTAL. TYPICAL OF 2.
 - 8 REMOVE EXISTING CONCRETE STAIRWELL WALLS AND HANDRAIL.
 - 9 REMOVE EXISTING MAN DOOR AND FRAME.
 - 10 REMOVE EXISTING COILING DOOR.
 - 11 REMOVE EXISTING CONCRETE CHANNEL WALLS, FLOOR SLAB AND GRAVEL FILL.
 - 12 REMOVE EXISTING CHECKER PLATE COVER.
 - 13 CORE DRILL EXISTING CONCRETE WALL FOR NEW 30" WW PIPE AND MODULAR MECHANICAL EXPANDING RUBBER SEAL. COORDINATE SIZE OF OPENING WITH MODULAR MECHANICAL SEAL VENDORS ENGINEER APPROVED SUBMITTAL.
 - 14 REMOVE EXISTING 6" PRE-CAST CONCRETE PANEL PITCHED ROOF, STANDING SEAM METAL ROOFING, ALL ASSOCIATED SUPPORTING STRUCTURES AND CONNECTIONS TO THE OUTSIDE FACE OF EXISTING SECONDARY TREATMENT COMPLEX. PITCHED ROOF SYSTEM COMPONENTS ARE IDENTIFIED FOR BIDDING PURPOSES ONLY AND CONTRACTOR SHALL FIELD VERIFY ACTUAL CONDITIONS AND COORDINATE WITH ENGINEER AND OWNER PRIOR TO BEGINNING REMOVAL.
 - 15 REMOVE EXISTING CONCRETE FLOOR SLAB.
 - 16 REMOVE EXISTING CANOPY SYSTEM.
 - 17 REMOVE EXISTING CONCRETE APRON.
 - 18 REMOVE EXISTING 8" FLANGED TEE.
 - 19 REMOVE 24" WIDE x 21" HIGH SECTION OF EXISTING CONCRETE WALL AND EXISTING WALL PIPE.
 - 20 REMOVE EXISTING SLIDE PLATE AND FRAME.

A SECTION
 M-1100 M-1101
 SCALE: 1/4"=1'-0"

B SECTION
 M-1100 M-1101
 SCALE: 1/4"=1'-0"

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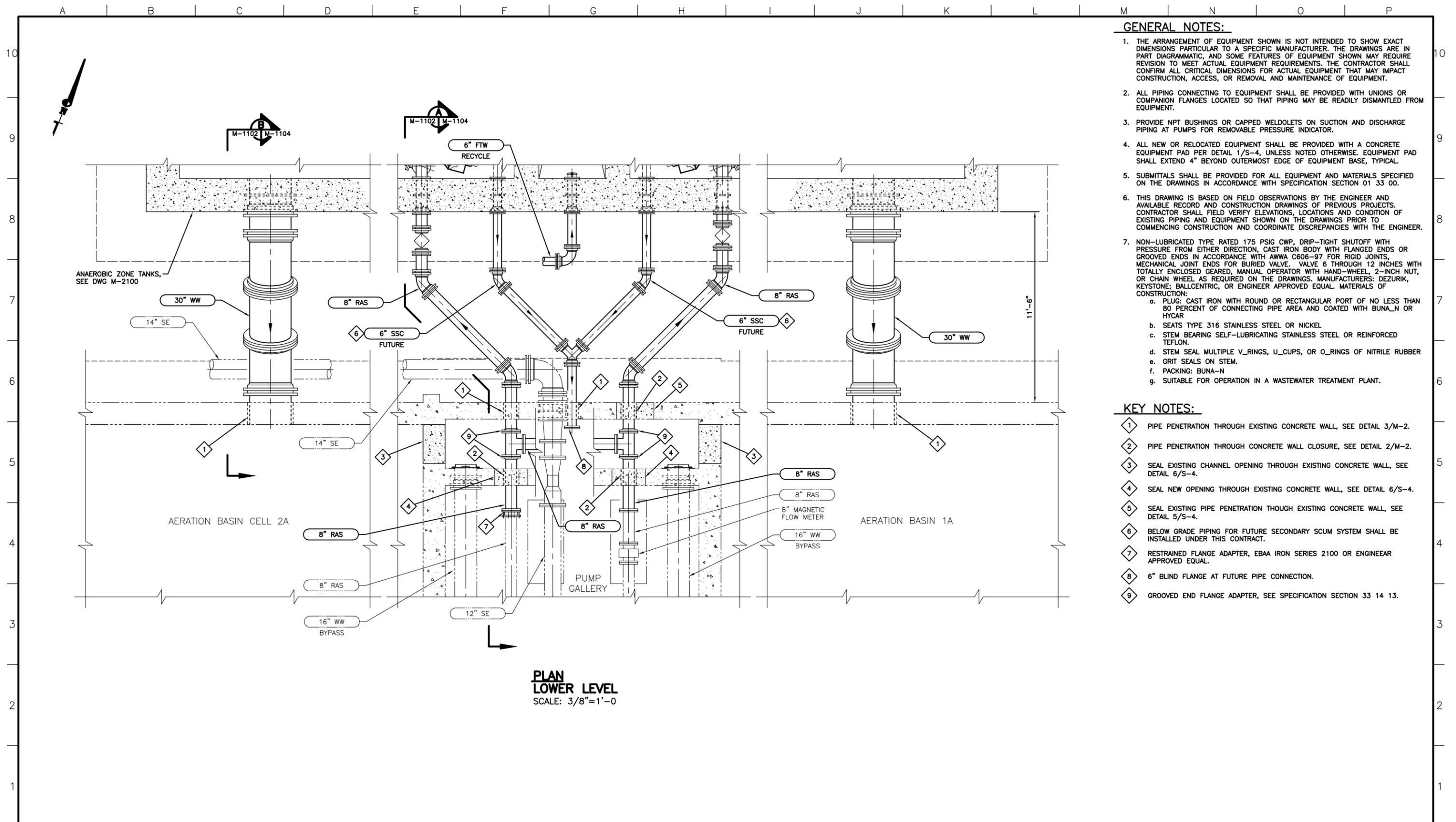
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SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
 ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

MECHANICAL
 EXISTING SECONDARY TREATMENT COMPLEX
 DEMOLITION SECTIONS

DATE: 08/29/24
 PROJECT NUMBER: 50161727
 REVISION NO. A
 DRAWING NUMBER
M-1101



GENERAL NOTES:

1. THE ARRANGEMENT OF EQUIPMENT SHOWN IS NOT INTENDED TO SHOW EXACT DIMENSIONS PARTICULAR TO A SPECIFIC MANUFACTURER. THE DRAWINGS ARE IN PART DIAGRAMMATIC, AND SOME FEATURES OF EQUIPMENT SHOWN MAY REQUIRE REVISION TO MEET ACTUAL EQUIPMENT REQUIREMENTS. THE CONTRACTOR SHALL CONFIRM ALL CRITICAL DIMENSIONS FOR ACTUAL EQUIPMENT THAT MAY IMPACT CONSTRUCTION, ACCESS, OR REMOVAL AND MAINTENANCE OF EQUIPMENT.
2. ALL PIPING CONNECTING TO EQUIPMENT SHALL BE PROVIDED WITH UNIONS OR COMPANION FLANGES LOCATED SO THAT PIPING MAY BE READILY DISMANTLED FROM EQUIPMENT.
3. PROVIDE NPT BUSHINGS OR CAPPED WELDOLETS ON SUCTION AND DISCHARGE PIPING AT PUMPS FOR REMOVABLE PRESSURE INDICATOR.
4. ALL NEW OR RELOCATED EQUIPMENT SHALL BE PROVIDED WITH A CONCRETE EQUIPMENT PAD PER DETAIL 1/S-4, UNLESS NOTED OTHERWISE. EQUIPMENT PAD SHALL EXTEND 4" BEYOND OUTERMOST EDGE OF EQUIPMENT BASE, TYPICAL.
5. SUBMITTALS SHALL BE PROVIDED FOR ALL EQUIPMENT AND MATERIALS SPECIFIED ON THE DRAWINGS IN ACCORDANCE WITH SPECIFICATION SECTION 01 33 00.
6. THIS DRAWING IS BASED ON FIELD OBSERVATIONS BY THE ENGINEER AND AVAILABLE RECORD AND CONSTRUCTION DRAWINGS OF PREVIOUS PROJECTS. CONTRACTOR SHALL FIELD VERIFY ELEVATIONS, LOCATIONS AND CONDITION OF EXISTING PIPING AND EQUIPMENT SHOWN ON THE DRAWINGS PRIOR TO COMMENCING CONSTRUCTION AND COORDINATE DISCREPANCIES WITH THE ENGINEER.
7. NON-LUBRICATED TYPE RATED 175 PSIG CWP, DRIP-TIGHT SHUTOFF WITH PRESSURE FROM EITHER DIRECTION, CAST IRON BODY WITH FLANGED ENDS OR GROOVED ENDS IN ACCORDANCE WITH AWWA C606-97 FOR RIGID JOINTS, MECHANICAL JOINT ENDS FOR BURIED VALVE. VALVE 6 THROUGH 12 INCHES WITH TOTALLY ENCLOSED GEARED, MANUAL OPERATOR WITH HAND-WHEEL, 2-INCH NUT, OR CHAIN WHEEL AS REQUIRED ON THE DRAWINGS. MANUFACTURERS: DEZURIK, KEYSTONE, BALLCENTRIC, OR ENGINEER APPROVED EQUAL. MATERIALS OF CONSTRUCTION:
 - a. PLUG: CAST IRON WITH ROUND OR RECTANGULAR PORT OF NO LESS THAN 80 PERCENT OF CONNECTING PIPE AREA AND COATED WITH BUNA-N OR HYCAR
 - b. SEATS TYPE 316 STAINLESS STEEL OR NICKEL
 - c. STEM BEARING SELF-LUBRICATING STAINLESS STEEL OR REINFORCED TEFLON.
 - d. STEM SEAL MULTIPLE V-RINGS, U-CUPS, OR O-RINGS OF NITRILE RUBBER
 - e. GRIT SEALS ON STEM.
 - f. PACKING: BUNA-N
 - g. SUITABLE FOR OPERATION IN A WASTEWATER TREATMENT PLANT.

KEY NOTES:

- 1 PIPE PENETRATION THROUGH EXISTING CONCRETE WALL, SEE DETAIL 3/M-2.
- 2 PIPE PENETRATION THROUGH CONCRETE WALL CLOSURE, SEE DETAIL 2/M-2.
- 3 SEAL EXISTING CHANNEL OPENING THROUGH EXISTING CONCRETE WALL, SEE DETAIL 6/S-4.
- 4 SEAL NEW OPENING THROUGH EXISTING CONCRETE WALL, SEE DETAIL 6/S-4.
- 5 SEAL EXISTING PIPE PENETRATION THROUGH EXISTING CONCRETE WALL, SEE DETAIL 5/S-4.
- 6 BELOW GRADE PIPING FOR FUTURE SECONDARY SCUM SYSTEM SHALL BE INSTALLED UNDER THIS CONTRACT.
- 7 RESTRAINED FLANGE ADAPTER, EBAA IRON SERIES 2100 OR ENGINEER APPROVED EQUAL.
- 8 6" BLIND FLANGE AT FUTURE PIPE CONNECTION.
- 9 GROOVED END FLANGE ADAPTER, SEE SPECIFICATION SECTION 33 14 13.

**PLAN
LOWER LEVEL**
SCALE: 3/8"=1'-0

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**SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO**

**ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION**

MECHANICAL

**EXISTING SECONDARY TREATMENT COMPLEX
LOWER LEVEL PLAN**

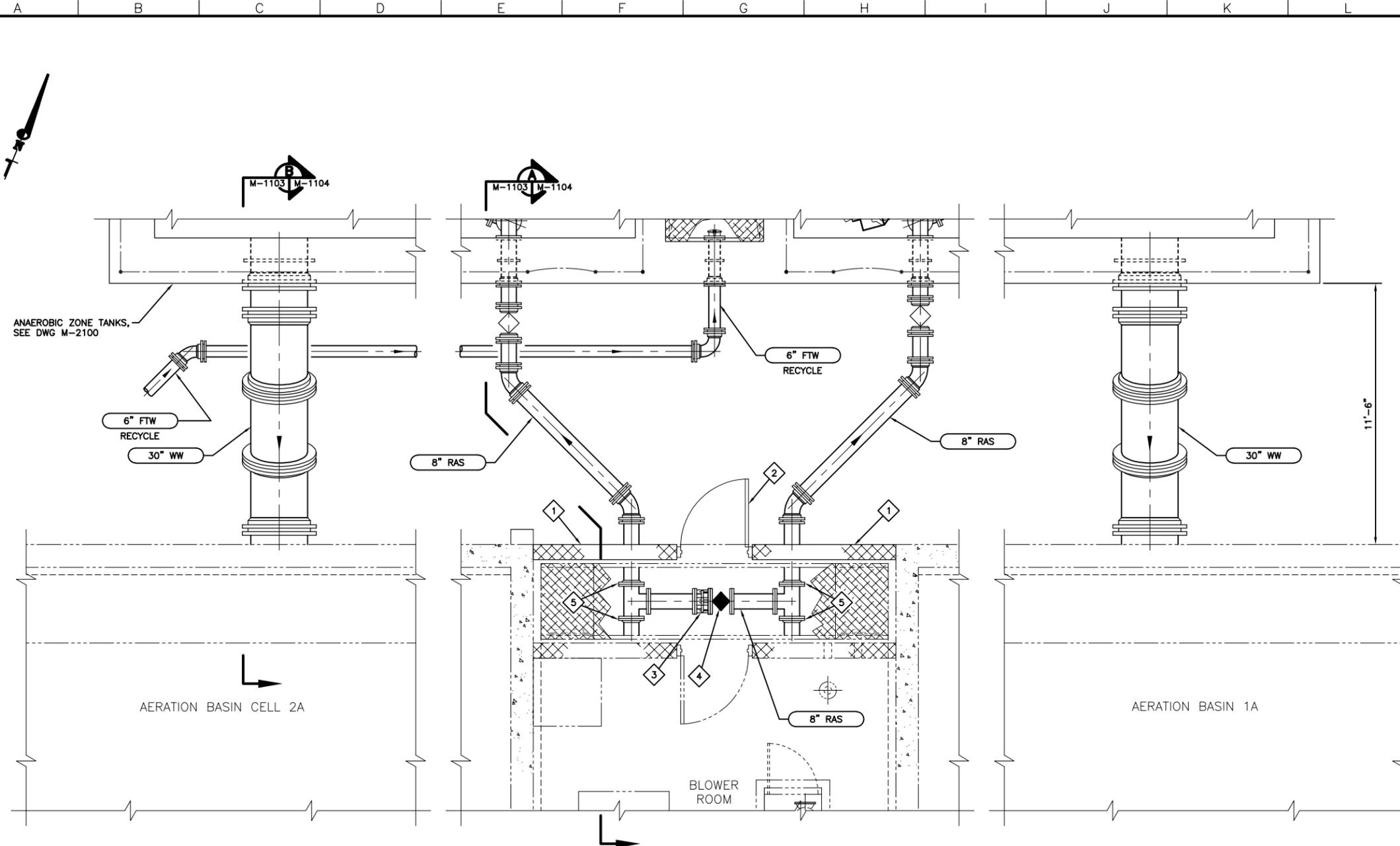
DATE: 09/02/24
PROJECT NUMBER: 50161727
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DRAWING NUMBER
M-1102

GENERAL NOTES:

1. THIS DRAWING IS BASED ON FIELD OBSERVATIONS BY THE ENGINEER AND AVAILABLE RECORD AND CONSTRUCTION DRAWINGS OF PREVIOUS PROJECTS. CONTRACTOR SHALL FIELD VERIFY ELEVATIONS, LOCATIONS AND CONDITION OF EXISTING PIPING AND EQUIPMENT SHOWN ON THE DRAWINGS PRIOR TO COMMENCING CONSTRUCTION AND COORDINATE DISCREPANCIES WITH THE ENGINEER.

KEY NOTES:

- 1 NEW 8" CMU WALL, SEE STRUCTURAL DRAWINGS FOR DETAILS.
- 2 NEW 3'-0" WIDE BY 7'-4" HIGH DOOR TO MATCH EXISTING COORDINATE WITH ENGINEER DURING CONSTRUCTION.
- 3 DISMANTLING JOINT, SEE SPECIFICATION SECTION 33 14 13.
- 4 FLANGED PLUG VALVE, NORMALLY CLOSED, GENERAL NOTE 7, DRAWING M-1102.
- 5 GROOVED END FLANGE ADAPTER, SEE SPECIFICATION SECTION 33 14 13.



**PLAN
GROUND LEVEL**
SCALE: 3/8"=1'-0"

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REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	JRA	09/05/24	PDR

**SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO**

**ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION**

MECHANICAL

EXISTING SECONDARY TREATMENT COMPLEX
GROUND LEVEL PLAN

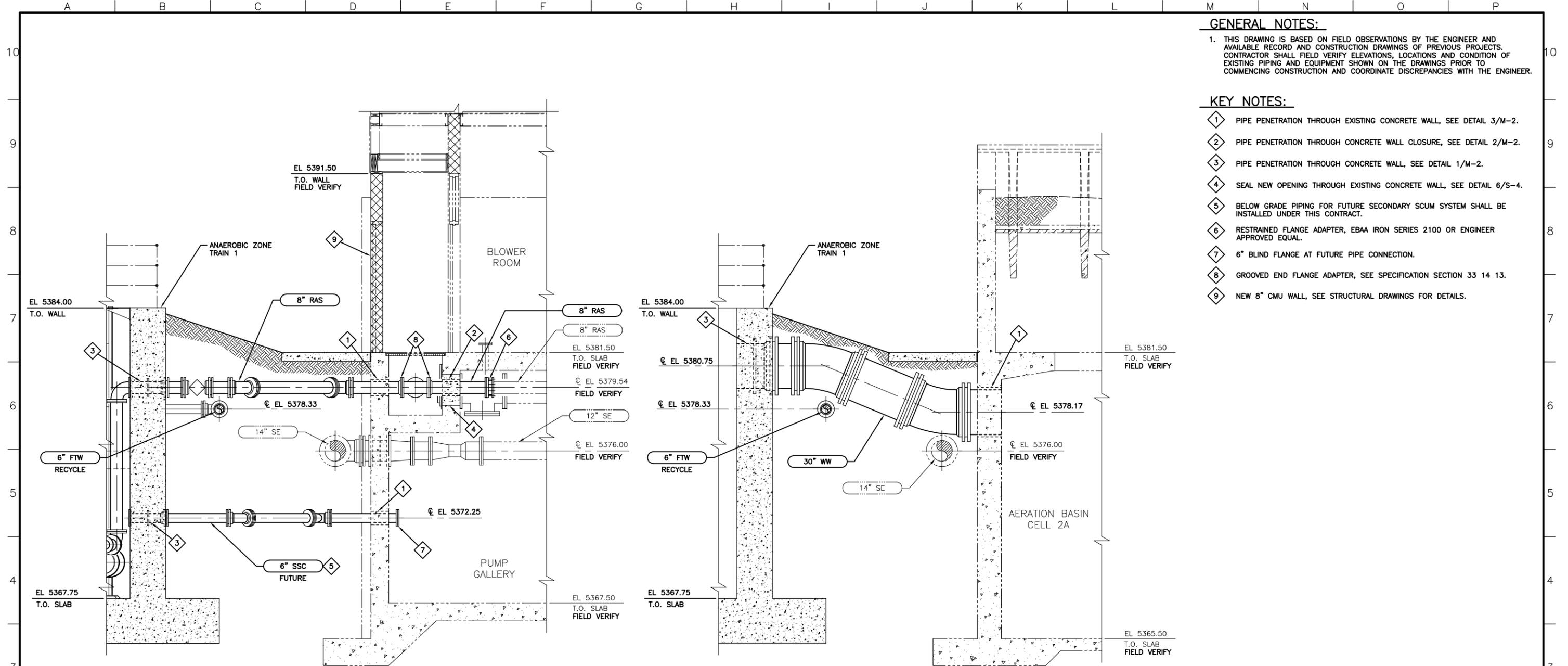
DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER
M-1103

GENERAL NOTES:

1. THIS DRAWING IS BASED ON FIELD OBSERVATIONS BY THE ENGINEER AND AVAILABLE RECORD AND CONSTRUCTION DRAWINGS OF PREVIOUS PROJECTS. CONTRACTOR SHALL FIELD VERIFY ELEVATIONS, LOCATIONS AND CONDITION OF EXISTING PIPING AND EQUIPMENT SHOWN ON THE DRAWINGS PRIOR TO COMMENCING CONSTRUCTION AND COORDINATE DISCREPANCIES WITH THE ENGINEER.

KEY NOTES:

- 1 PIPE PENETRATION THROUGH EXISTING CONCRETE WALL, SEE DETAIL 3/M-2.
- 2 PIPE PENETRATION THROUGH CONCRETE WALL CLOSURE, SEE DETAIL 2/M-2.
- 3 PIPE PENETRATION THROUGH CONCRETE WALL, SEE DETAIL 1/M-2.
- 4 SEAL NEW OPENING THROUGH EXISTING CONCRETE WALL, SEE DETAIL 6/S-4.
- 5 BELOW GRADE PIPING FOR FUTURE SECONDARY SCUM SYSTEM SHALL BE INSTALLED UNDER THIS CONTRACT.
- 6 RESTRAINED FLANGE ADAPTER, EBAA IRON SERIES 2100 OR ENGINEER APPROVED EQUAL.
- 7 6" BLIND FLANGE AT FUTURE PIPE CONNECTION.
- 8 GROOVED END FLANGE ADAPTER, SEE SPECIFICATION SECTION 33 14 13.
- 9 NEW 8" CMU WALL, SEE STRUCTURAL DRAWINGS FOR DETAILS.



A SECTION
M-1102, M1103 | M-1104
SCALE: 3/8"=1'-0

B SECTION
M-1102, M1103 | M-1104
SCALE: 3/8"=1'-0

Dewberry
Dewberry Engineers Inc.
990 S. BROADWAY, SUITE 400
Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES
AT FULL SIZE
(IF NOT 2"=SCALE ACCORDINGLY)
DRAWING MPL61727-1104
DRAWN JRA
DESIGNED MDS
CHECKED PDR

APPROVED:
PRINCIPAL
DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

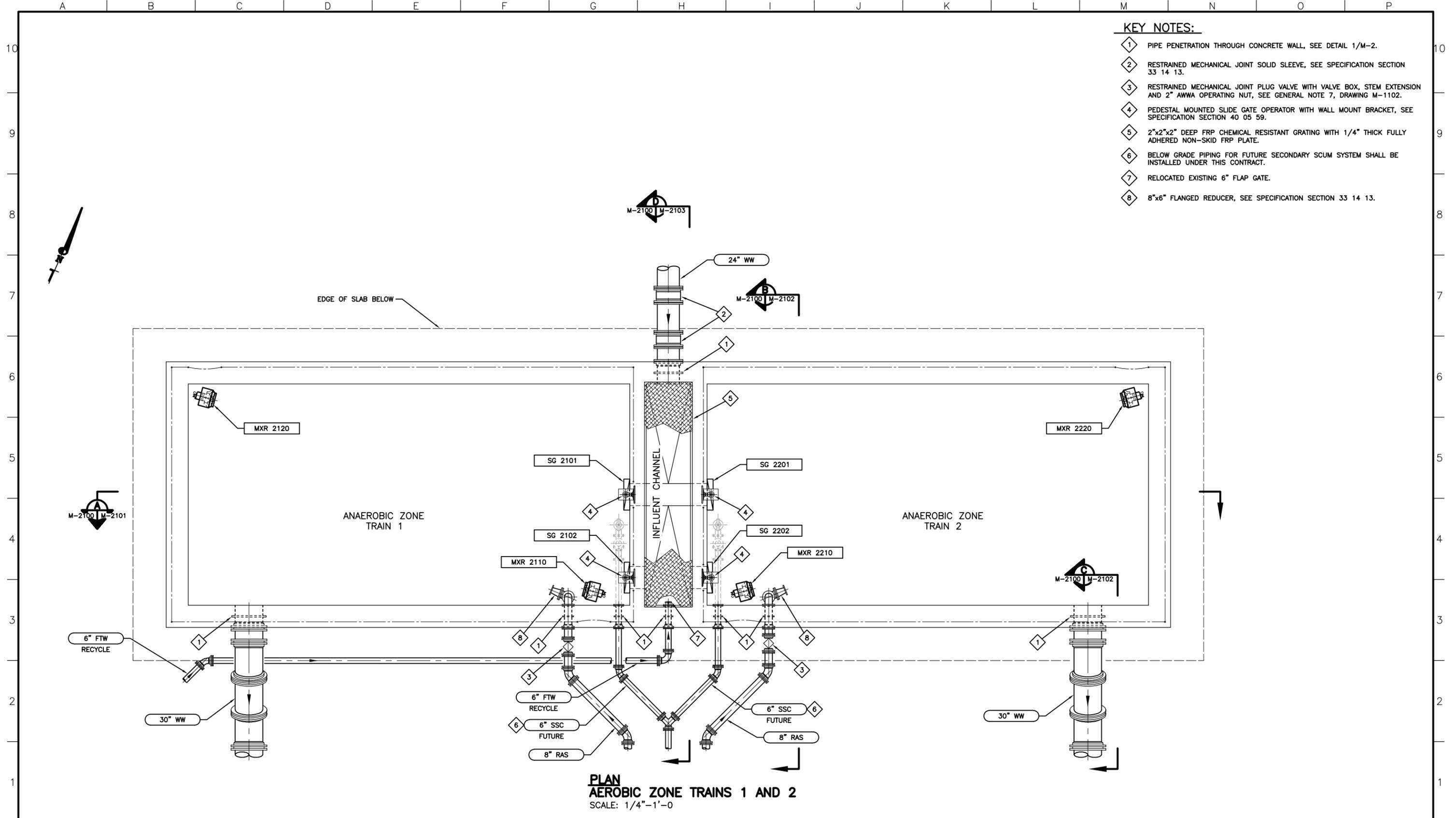
MECHANICAL

EXISTING SECONDARY TREATMENT COMPLEX
SECTIONS

DATE: 09/02/24
PROJECT NUMBER: 50161727
REVISION NO. A
DRAWING NUMBER
M-1104

KEY NOTES:

- 1 PIPE PENETRATION THROUGH CONCRETE WALL, SEE DETAIL 1/M-2.
- 2 RESTRAINED MECHANICAL JOINT SOLID SLEEVE, SEE SPECIFICATION SECTION 33 14 13.
- 3 RESTRAINED MECHANICAL JOINT PLUG VALVE WITH VALVE BOX, STEM EXTENSION AND 2" AWWA OPERATING NUT, SEE GENERAL NOTE 7, DRAWING M-1102.
- 4 PEDESTAL MOUNTED SLIDE GATE OPERATOR WITH WALL MOUNT BRACKET, SEE SPECIFICATION SECTION 40 05 59.
- 5 2"x2"x2" DEEP FRP CHEMICAL RESISTANT GRATING WITH 1/4" THICK FULLY ADHERED NON-SKID FRP PLATE.
- 6 BELOW GRADE PIPING FOR FUTURE SECONDARY SCUM SYSTEM SHALL BE INSTALLED UNDER THIS CONTRACT.
- 7 RELOCATED EXISTING 6" FLAP GATE.
- 8 8"x6" FLANGED REDUCER, SEE SPECIFICATION SECTION 33 14 13.



**PLAN
ANAEROBIC ZONE TRAINS 1 AND 2**
SCALE: 1/4"=1'-0"

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LINE IS 2 INCHES
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DRAWING MPL61727-2100
DRAWN JRA
DESIGNED MDS
CHECKED MDS

APPROVED:

PRINCIPAL
DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	MDS
B	ISSUED FOR BID	JRA	09/05/24	PDR

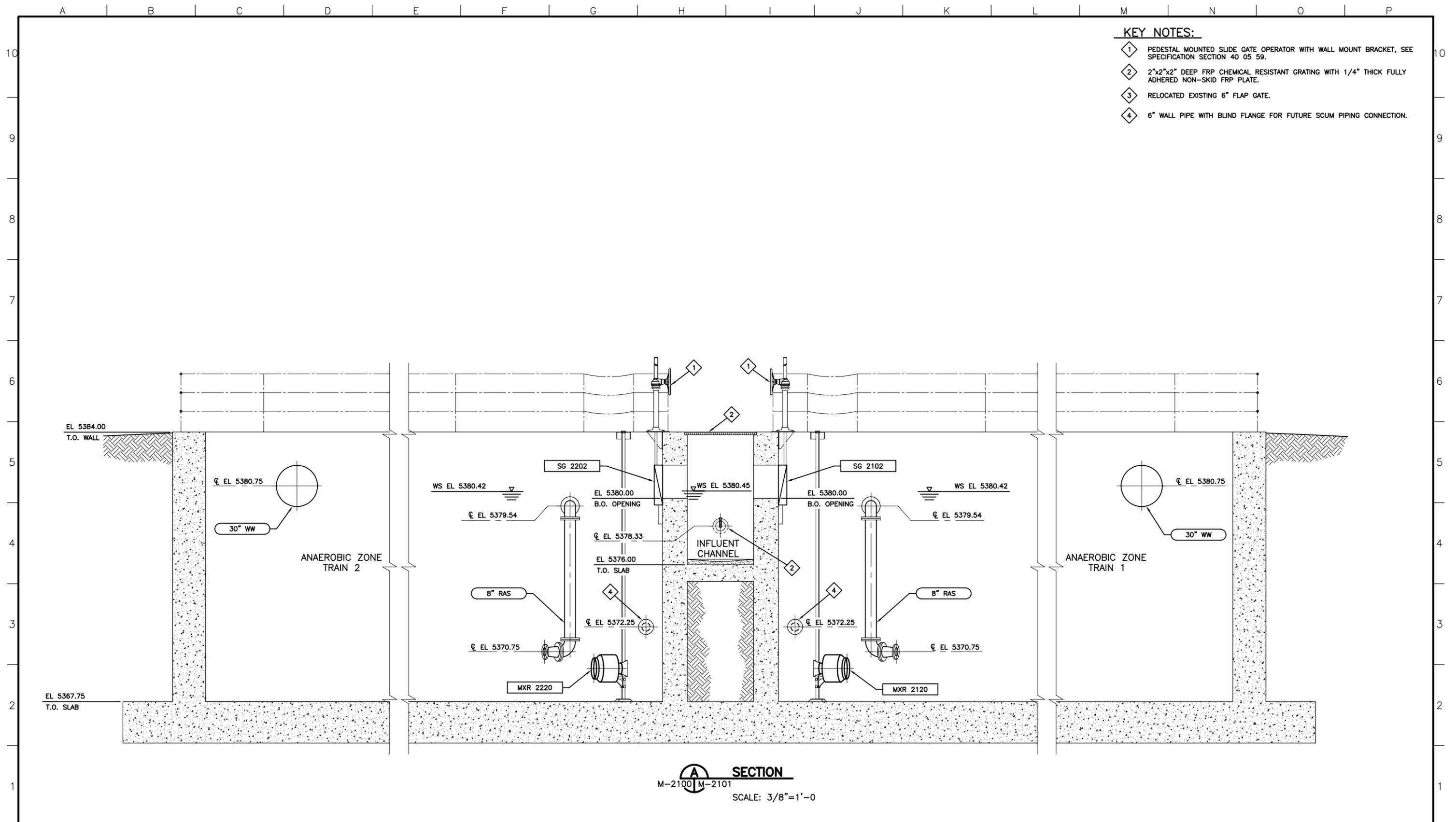
**SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO**

**ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION**

MECHANICAL

**ANAEROBIC ZONE TRAINS 1 AND 2
PLAN**

DATE: 07/26/24
PROJECT NUMBER: 50161727
REVISION NO. B
DRAWING NUMBER
M-2100



- KEY NOTES:**
- 1 PEDESTAL MOUNTED SLIDE GATE OPERATOR WITH WALL MOUNT BRACKET, SEE SPECIFICATION SECTION 40 05 59.
 - 2 2"x2"x2" DEEP FRP CHEMICAL RESISTANT GRATING WITH 1/4" THICK FULLY ADHERED NON-SKID FRP PLATE.
 - 3 RELOCATED EXISTING 6" FLAP GATE.
 - 4 6" WALL PIPE WITH BLIND FLANGE FOR FUTURE SCUM PIPING CONNECTION.

A SECTION
 M-2100 | M-2101
 SCALE: 3/8"=1'-0"

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 990 S. BROADWAY, SUITE 400
 Denver, Colorado 80209
 (303) 825-1802

LINE IS 2 INCHES
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 (IF NOT 2"=SCALE ACCORDINGLY)
 DRAWING MPL61727-2101
 DRAWN JRA
 DESIGNED MDS
 CHECKED MDS

APPROVED:

 PRINCIPAL
 DATE: _____

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	MDS
B	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
 SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

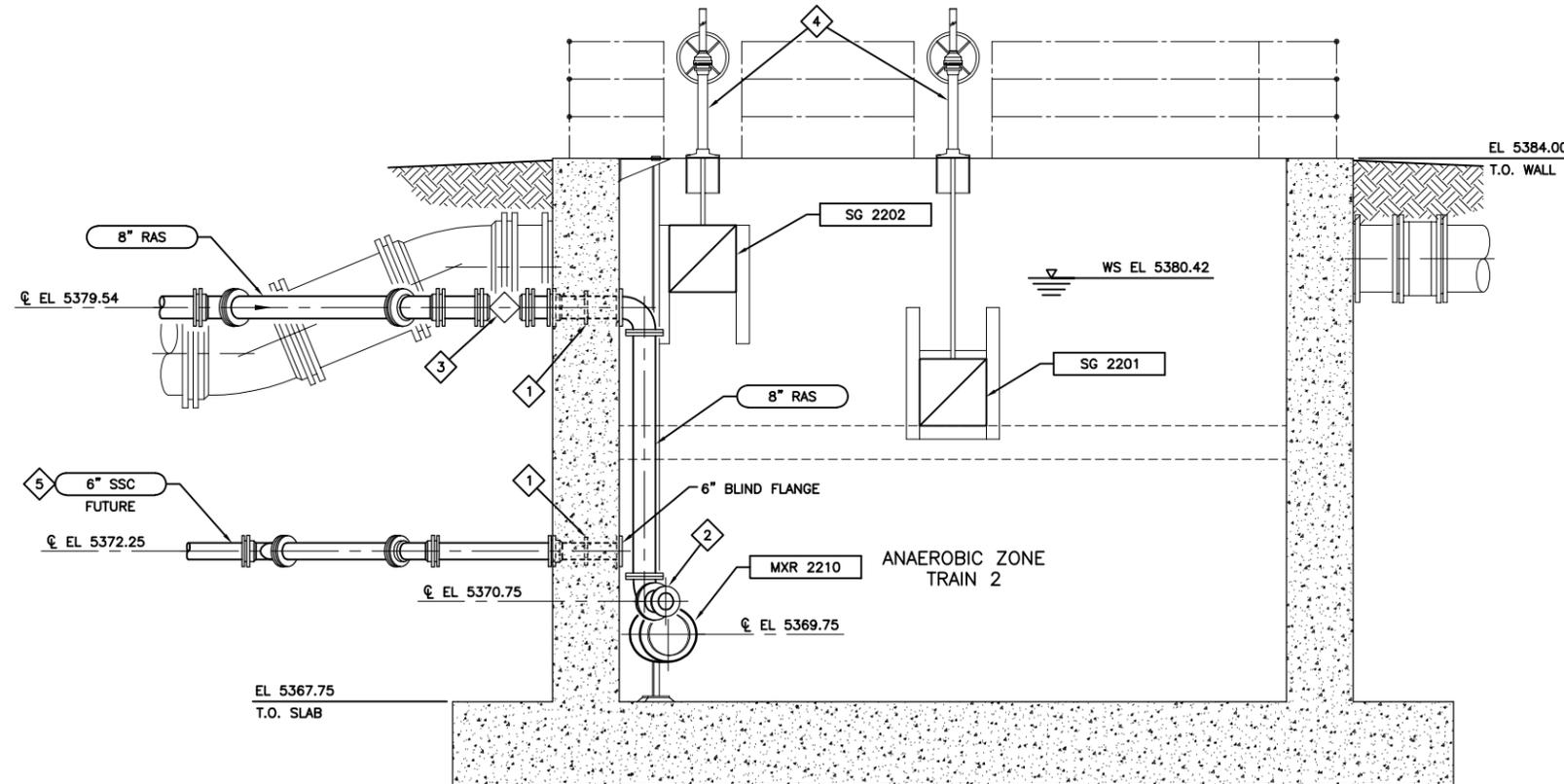
MECHANICAL

ANAEROBIC ZONE TRAINS 1 AND 2
 SECTION

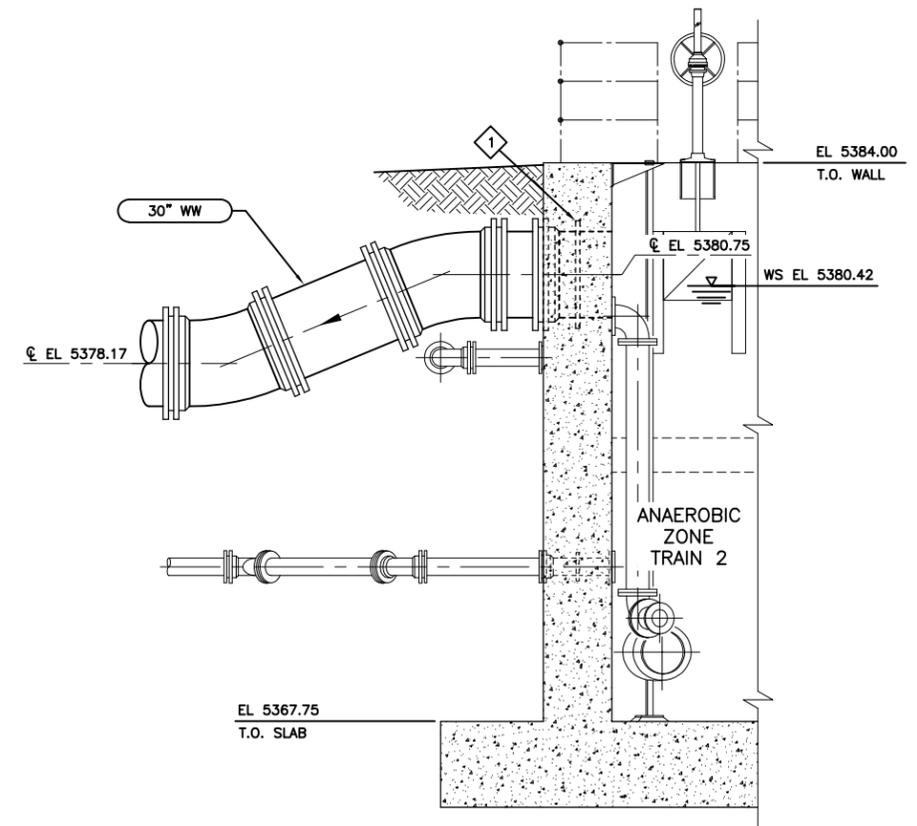
DATE: 07/26/24
 PROJECT NUMBER: 50161727
 REVISION NO. B
 DRAWING NUMBER
M-2101

KEY NOTES:

- 1 PIPE PENETRATION THROUGH CONCRETE WALL, SEE DETAIL 1/M-2.
- 2 8"x6" FLANGED REDUCER.
- 3 RESTRAINED MECHANICAL JOINT PLUG VALVE WITH VALVE BOX, STEM EXTENSION AND 2" AWWA OPERATING NUT, SEE GENERAL NOTE 7, DRAWING M-1102.
- 4 PEDESTAL MOUNTED SLIDE GATE OPERATOR WITH WALL MOUNT BRACKET, SEE SPECIFICATION SECTION 40 05 59.
- 5 BELOW GRADE PIPING FOR FUTURE SECONDARY SCUM SYSTEM SHALL BE INSTALLED UNDER THIS CONTRACT.



B SECTION
M-2100 | M-2102
SCALE: 3/8"=1'-0



C SECTION
M-2100 | M-2102
SCALE: 3/8"=1'-0

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LINE IS 2 INCHES
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DRAWING MPL61727-2102
DRAWN JRA
DESIGNED MDS
CHECKED MDS

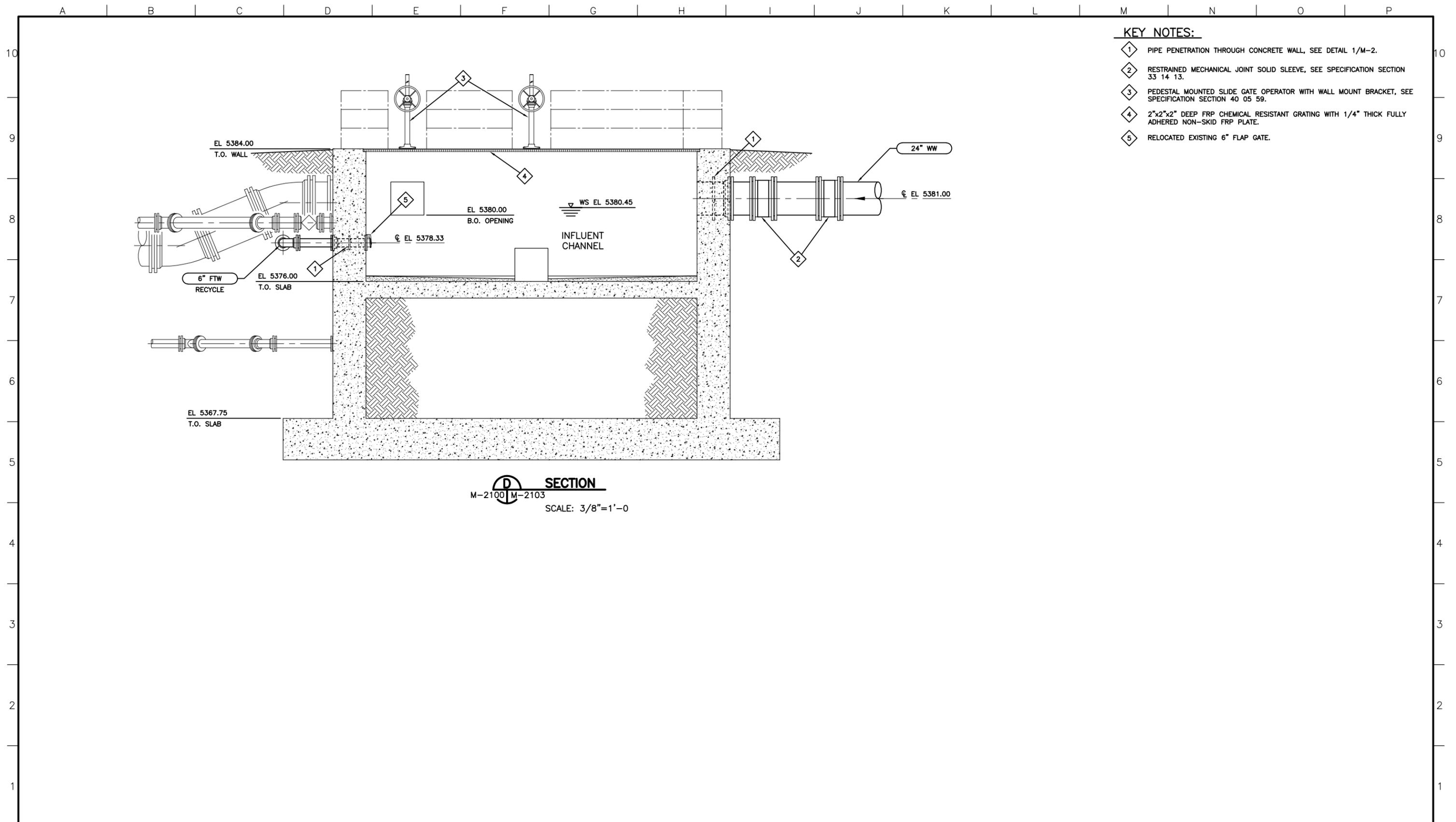
APPROVED:
PRINCIPAL
DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	30% DESIGN REVIEW SUBMITTAL	JRA	08/01/24	MDS
B	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

MECHANICAL
ANAEROBIC ZONE TRAINS 1 AND 2
SECTIONS

DATE: 07/26/24
PROJECT NUMBER: 50161727
REVISION NO. B
DRAWING NUMBER
M-2102



- KEY NOTES:**
- 1 PIPE PENETRATION THROUGH CONCRETE WALL, SEE DETAIL 1/M-2.
 - 2 RESTRAINED MECHANICAL JOINT SOLID SLEEVE, SEE SPECIFICATION SECTION 33 14 13.
 - 3 PEDESTAL MOUNTED SLIDE GATE OPERATOR WITH WALL MOUNT BRACKET, SEE SPECIFICATION SECTION 40 05 59.
 - 4 2"x2"x2" DEEP FRP CHEMICAL RESISTANT GRATING WITH 1/4" THICK FULLY ADHERED NON-SKID FRP PLATE.
 - 5 RELOCATED EXISTING 6" FLAP GATE.

D SECTION
 M-2100 | M-2103
 SCALE: 3/8"=1'-0

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LINE IS 2 INCHES
 AT FULL SIZE
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DRAWING MPL61727-2103
 DRAWN JRA
 DESIGNED MDS
 CHECKED MDS

APPROVED:

PRINCIPAL

DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	ISSUED FOR REVIEW	JRA	08/03/24	MDS
B	ISSUED FOR BID	JRA	09/05/24	PDR

SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

MECHANICAL

ANAEROBIC ZONE TRAINS 1 AND 2
 SECTION

DATE: 08/03/24
 PROJECT NUMBER: 50161727
 REVISION NO. A
 DRAWING NUMBER
M-2103

ELECTRICAL LEGEND:

ABBREVIATIONS:

LIGHTING:

- X DENOTES FIXTURE TYPE (TYP.) SEE FIXTURE SCHEDULE
- # DENOTES CIRCUIT NUMBER (TYP.)

RECEPTACLES:

- X DENOTES RECEPTACLE TYPE (TYP.):
- GFCI: GROUND FAULT CIRCUIT INTERRUPT
- UPS: UNINTERRUPTIBLE POWER SUPPLY
- WPCR: WEATHERPROOF CORROSION RESISTANT
- # DENOTES CIRCUIT NUMBER (TYP.)

SWITCHES

- WALL SWITCH: X DENOTES TYPE: NO SUBSCRIPT: SINGLE-POLE SWITCH 3: 3-WAY SWITCH 4: 4-WAY SWITCH M: MANUAL MOTOR STARTER # DENOTES CIRCUIT NUMBER
- COMBINATION MOTOR STARTER
- DISCONNECT SWITCH
- LOCAL CONTROL STATION

WIRING

- PROPOSED
- EXISTING
- CONDUIT EXPOSED
- CONDUIT UNDERGROUND
- CONDUIT HOMERUN

MISC PLAN VIEW SYMBOLS

- EQUIPMENT CONNECTION
- INSTRUMENT TAG: X DENOTES INSTRUMENT TYPE # DENOTES INSTRUMENT NUMBER
- CONDUIT TAGS: P DENOTES POWER C DENOTES CONTROL I DENOTES INSTRUMENTATION XXXX DENOTES CONDUIT ID
- THERMOSTAT

EQUIPMENT/DEVICE LOCATION SYMBOLS

- * LOCATED IN MCC
- LOCATED IN STAND-ALONE MOTOR STARTER/CONTROLLER
- △ LOCATED IN FIELD
- LOCATED AT PANEL: X DENOTES PANEL ID: L DENOTES LCS

GROUNDING

- GROUND RODS: LEFT: BURIED RIGHT: IN TESTWELL
- CAD WELD TERMINATION
- #4/0 BCC
- UNDERGROUND ELECTRICAL

SINGLE-LINE DIAGRAMS

TRANSFORMER ID
45kVA
480-120/208V

TRANSFORMER
3P/4W
DRY TRANS

MOTOR & TYP. ADDITIONAL DEVICES:
TSH: TEMPERATURE SWITCH
MSH: MOTOR SPACE HEATER
CF: COOLING FAN
TE: TEMPERATURE ELEMENT
ME: MOISTURE DETECTOR
RTD: RESISTANCE TEMPERATURE DETECTOR

INSTRUMENT TAG:
X DENOTES INSTRUMENT TYPE
Y DENOTES INSTRUMENT NUMBER

100A FUSE

DISCONNECT SWITCH:
LEFT: DOUBLE THROW
RIGHT: SINGLE THROW

LOW-VOLTAGE MOLDED CASE CIRCUIT BREAKER

30A MCP

MOTOR CIRCUIT PROTECTOR

GROUND

CT: NUMBERS DENOTE CT WINDING RATIO AND CT QUANTITY

PT: NUMBERS DENOTE PT WINDING VOLTAGES AND PT QUANTITY

LEFT: RESISTOR
RIGHT: LINE REACTOR:
#% DENOTES IMPEDANCE

SURGE PROTECTIVE DEVICE

30A MCP

FVNR STARTER:
X DENOTES NEMA SIZE

VARIABLE FREQUENCY DRIVE

50kW
480V, 3φ, 4W

GENERATOR

ATS
480V, 600A
13φ, 4W, 3P
OPEN TRANSITION
NEMA 3R
22kAIC

AUTOMATIC TRANSFER SWITCH OR
MANUAL TRANSFER SWITCH
CONTACTOR STYLE

LIGHTNING ARRESTOR

LOW-VOLTAGE POWER CIRCUIT BREAKER:
LEFT: FIXED-MOUNT
RIGHT: DRAWOUT
E.O. DENOTES ELECTRICALLY OPERATED
LSIG DENOTES INSTALLED TRIP FUNCTIONS:
L DENOTES LONG-TIME
S DENOTES SHORT-TIME
I DENOTES INSTANTANEOUS
G DENOTES GROUND FAULT
CTR DENOTES BREAKER-SPECIFIC CT AND RATIOS

DRAW-OUT ELEMENT

ELEMENTARY CONTROL SCHEMATICS

3-POSITION SELECTOR SWITCH:
HOA DENOTES HAND/OFF/AUTO
LOR DENOTES LOCAL/OFF/REMOTE
FOR DENOTES FORWARD/OFF/REVERSE

MUSHROOM HEAD EMERGENCY STOP PUSHBUTTON
SWITCH N.C. MAINTAINED: TEXT DENOTES LEGEND PLATE

THERMAL OVERLOAD RELAY

NOTATION LEGEND:
NO/NC: NORMALLY OPEN/CLOSED
RO/RC: RISE-TO-OPEN/CLOSE
FO/FC: FALL-TO-OPEN/CLOSE
TO/TC: TIME-OPEN/CLOSE

CONTACTS:
TEXT DENOTES COIL ID

SWITCHES:
TEXT DENOTES TAG NUMBER

TEMPERATURE SWITCHES/THERMOSTATS

PRESSURE SWITCHES

TIME DELAY SWITCHES

INDICATOR LIGHT:
LEFT: STANDARD/RIGHT: PUSH-TO-TEST
X DENOTES COLOR

RUN TIME METER

SOLENOID VALVE

MOTOR PROTECTION RELAY

CONTROL POWER TRANSFORMER

MECHANICAL INTERLOCK CONNECTION

MOTOR SPACE HEATER

COIL:
X DENOTES TYPE:
M DENOTES MOTOR STARTER
CR DENOTES CONTROL RELAY
TD DENOTES TIME DELAY RELAY
PR DENOTES INTERPOSING PILOT RELAY
LC DENOTES LIGHTING CONTACTOR
Y DENOTES REFERENCE LINE NUMBER

AF	AMPERE FRAME
AFF	ABOVE FINISHED FLOOR
AIC	AMPERE INTERRUPTING CAPACITY
ANSI	AMERICAN NATIONAL STANDARDS INSTITUTE
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASME	AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AT	AMPERE TRIP
BCC	BARE COPPER CONDUCTOR
BKR	BREAKER
CJB	CONTROL JUNCTION BOX
CPB	CONTROL PULL BOX
CPT	CONTROL POWER TRANSFORMER
CT	CURRENT TRANSFORMER
CP	CONTROL PANEL
CV	CHECK VALVE
DB	DUCTBANK
DSW	DISCONNECT SWITCH
ECB	ENCLOSED CIRCUIT BREAKER
EHH	ELECTRICAL HANDHOLE
ETU	ELECTRONIC TRIP UNIT
FB	FILTER BUILDING
FE	FLOW ELEMENT
FIT	FLOW INDICATING TRANSMITTER
FVNR	FULL VOLTAGE NON-REVERSING
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
ISO	INTERNATIONAL ORGANIZATION FOR STANDARDIZATION
G	GROUND
GMF	GREEN MOUNTAIN FALLS
GND	GROUND
GST	GROUND STORAGE TANK
HOA	HAND-OFF-AUTO
JBX	JUNCTION BOX
LCS	LOCAL CONTROL STATION
LP	LIGHTING PANEL
LS	LEVEL SWITCH/LIMIT SWITCH
LSL	LEVEL SWITCH LOW
LSLL	LEVEL SWITCH LOW-LOW
LSH	LEVEL SWITCH HIGH
LSHH	LEVEL SWITCH HIGH-HIGH
MANUF	MANUFACTURER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MPR	MOTOR PROTECTION RELAY
MS	MOTOR STARTER
MSH	MOTOR SPACE HEATER
MTD	MOUNTED
MTS	MANUAL TRANSFER SWITCH
MWTS	MOTOR WINDING TEMPERATURE SWITCH
N4X	NEMA 4X SST
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NTS	NOT TO SCALE
OL	OVERLOAD
PCP	PUMP CONTROL PANEL
PC	PHOTOCELL
PIT	PRESSURE INDICATING TRANSMITTER
PLC	PROGRAMMABLE LOGIC CONTROLLER
PP	POWER PANEL
PSH	PRESSURE SWITCH HIGH
PSL	PRESSURE SWITCH LOW
PT	POTENTIAL TRANSFORMER/PRESSURE TRANSDUCER
RECP	RECEPTACLE
RTD	RESISTANCE TEMPERATURE DETECTOR

RTU	REMOTE TELEMETRY UNIT
RVSS	REDUCED VOLTAGE SOFT STARTER
SDBC	SOFT DRAWN BARE COPPER
S.E.	SERVICE ENTRANCE
SP C.	SPARE CONDUIT
SPD	SURGE PROTECTIVE DEVICE
SST	STAINLESS STEEL
SV	SOLENOID VALVE
SWBD	SWITCHBOARD
TSH	TWISTED SHIELDED
TSP	TWISTED SHIELDED PAIR
TX	TRANSFORMER
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHER PROOF & INUSE COVER
WPCR	WEATHER PROOF CORROSION RESISTANT
XFMR	TRANSFORMER

- ### GENERAL NOTES:
- THESE DRAWINGS ARE GENERALLY DIAGRAMMATIC AND DO NOT SHOW ALL DETAILS REQUIRED FOR THE COMPLETE SYSTEM. THEY SHOULD HOWEVER BE FOLLOWED AS CLOSELY AS POSSIBLE IN THE GENERAL ARRANGEMENT AND LOCATION OF EQUIPMENT. ALL DIMENSIONS SHALL BE CHECKED AT THE BUILDING AND ALL STRUCTURAL AND FINISH CONDITIONS INVESTIGATED. THE CONTRACTOR SHALL ARRANGE HIS WORK TO MEET THESE CONDITIONS AND PROVIDE SUCH EQUIPMENT AND ACCESSORIES AS MAY BE REQUIRED.
 - PROPERLY SUPPORT ALL WORK AND EQUIPMENT INSTALLED UNDER THIS CONTRACT PLUMB AND PARALLEL. STUDY ALL GENERAL, STRUCTURAL, MECHANICAL, AND ELECTRICAL DRAWINGS, SHOP DRAWINGS, AND CATALOG DATA TO DETERMINE HOW EQUIPMENT, ACCESSORIES, PIPING, FIXTURES, AND RELATED ITEMS ARE TO BE SUPPORTED, MOUNTED, OR SUSPENDED. PROVIDE ALL BOLTS, INSERTS, PIPE STANDS, BRACKETS, STRUCTURAL SUPPORTS, AND ACCESSORIES FOR PROPER SUPPORT OF EQUIPMENT FURNISHED UNDER THIS CONTRACT. COORDINATE THE ELECTRICAL WORK WITH ALL OTHER CONTRACTORS BEFORE BEGINNING WORK TO ENSURE THAT THE ELECTRICAL WORK DOES NOT INTERFERE WITH OTHER WORK.
 - NOTIFY THE ENGINEER IN WRITING IMMEDIATELY UPON DISCOVERY OF ANY DISCREPANCY OR POINTS OF CONFLICT IN THE DRAWINGS OR THE SPECIFICATIONS.
 - UNLESS OTHERWISE SPECIFIED OR NOTED, ALL WALL MOUNTED ELECTRICAL PANELS, ENCLOSURES, AND SIMILAR EQUIPMENT SHALL BE MOUNTED 6"-6" (MAX) FROM THE TOP OF THE PANEL TO FINISHED FLOOR OR GRADE.
 - UNLESS OTHERWISE NOTED, ALL LIGHTING SWITCHES, CONTROL SWITCHES, AND SIMILAR EQUIPMENT SHALL BE MOUNTED WITH THEIR CENTERLINE APPROXIMATELY 4'-0" ABOVE FINISHED FLOOR, SLAB, OR GRADE. THERMOSTATS SHALL BE MOUNTED 4'-4" ABOVE FINISHED FLOOR.
 - A SEPARATE EQUIPMENT GROUNDING CONDUCTOR SHALL BE PROVIDED FOR EACH CIRCUIT (SEPARATE CONDUCTOR IN THE CONDUIT). THE CONDUCTOR SHALL BE TERMINATED AT THE PROPER DEVICE, TERMINAL OR LUG AT THE POWER SOURCE (MCC GROUND BUS, PANELBOARD GROUND BUS, ETC.). GROUND CONDUCTOR SIZE SHALL BE PER THE LATEST EDITION OF THE NEC.
 - ALL CONDUIT HOMERUNS ARE NOT SHOWN ON DRAWINGS. CONTRACTOR SHALL REFER TO CONDUIT AND WIRE SCHEDULE, RISER DIAGRAMS, SINGLE LINE DIAGRAMS, AND OTHER DRAWINGS FOR CONDUIT AND WIRE REQUIREMENTS.
 - INSTALLATION SHALL BE IN COMPLIANCE WITH THE NEC, BUILDING CODE, AND LOCAL CODES. CONTRACTOR IS RESPONSIBLE FOR COORDINATING WITH LOCAL ADJ CONCERNING PERMITS, INSPECTION, AND INSTALLATION.

Dewberry
Dewberry Engineers Inc.
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Denver, Colorado 80209
(303) 825-1802

LINE IS 2 INCHES AT FULL SIZE (IF NOT 2"-SCALE ACCORDINGLY)

DRAWING EGL61727-01
DRAWN RML
DESIGNED RML
CHECKED XX

APPROVED:

PRINCIPAL

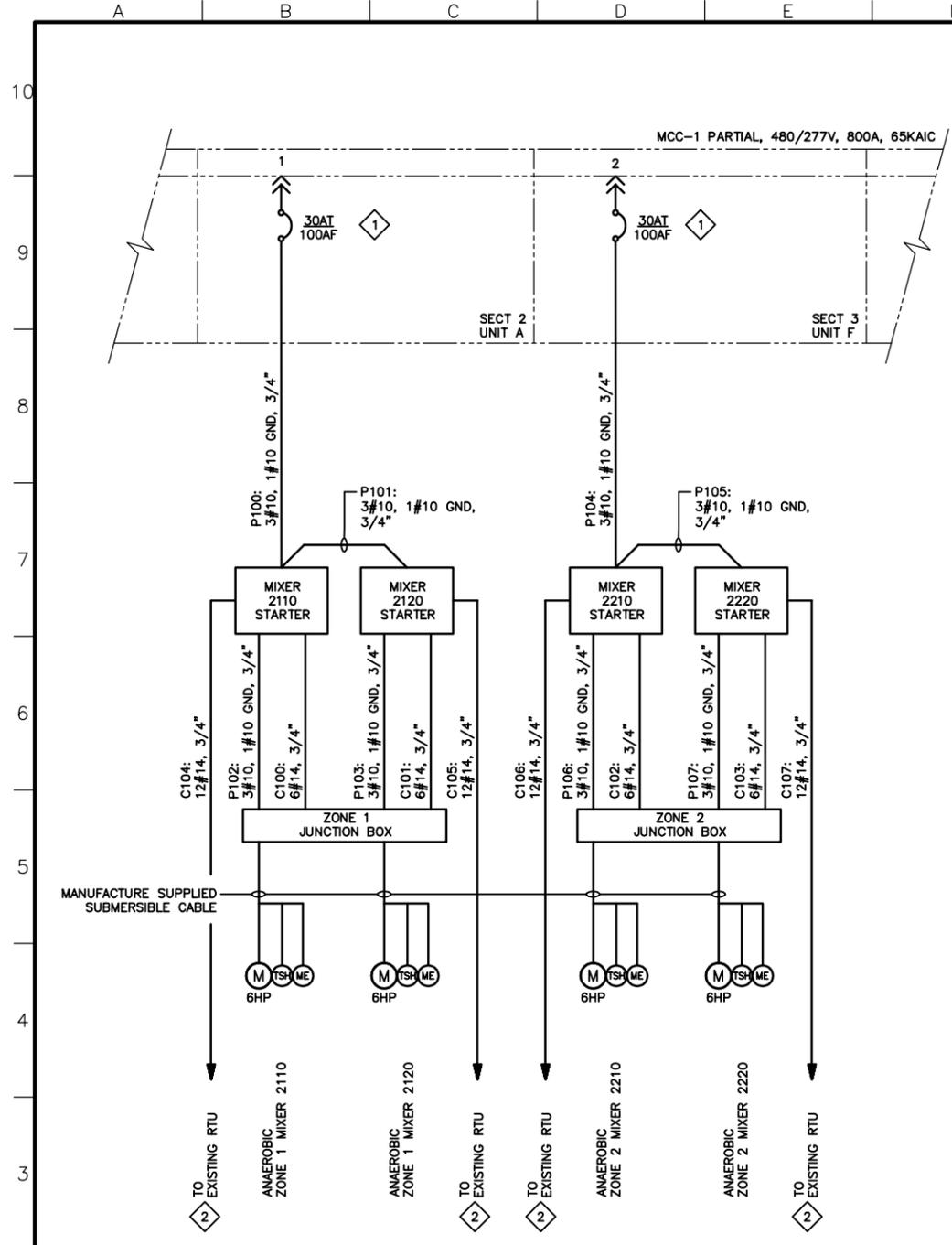
DATE:

REVISIONS				
REV.	DESCRIPTION	BY	DATE	APP.
A	60% DESIGN REVIEW	RML	8/20/24	XX
B	ISSUED FOR BID	RML	09/05/24	XX

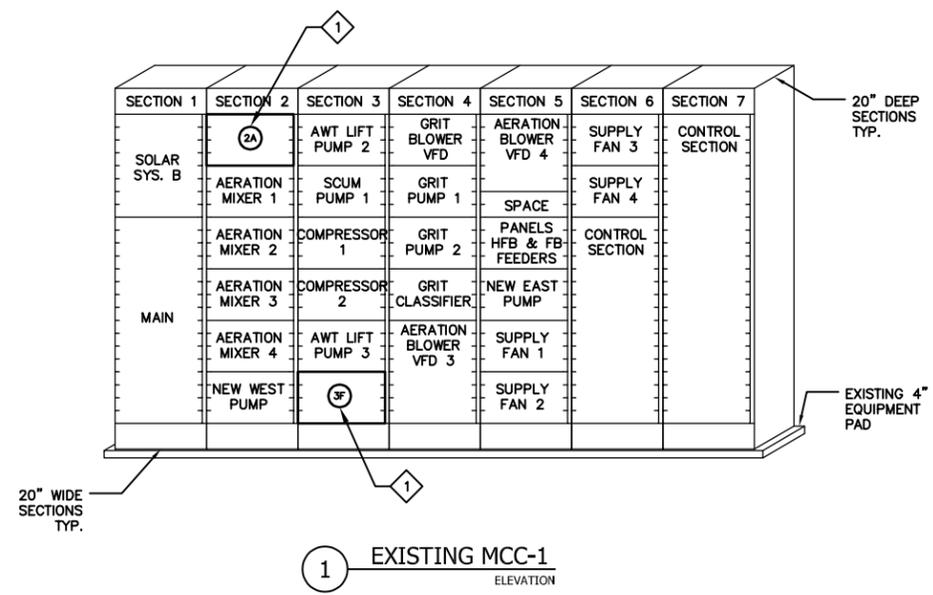
**SUPERIOR METROPOLITAN DISTRICT NO. 1
SUPERIOR, COLORADO**

**ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION**

ELECTRICAL		DATE: 8/20/24
LEGEND AND ABBREVIATIONS		PROJECT NUMBER: 50161727
		REVISION NO. B
		DRAWING NUMBER E-01



ONE-LINE DIAGRAM
EXISTING MOTOR CONTROL CENTER, MCC-1
 NO SCALE



1 EXISTING MCC-1
 ELEVATION

GENERAL NOTES:

- CONTRACTOR SHALL PROVIDE AND INSTALL NEW EQUIPMENT AS SHOWN.
- THE EXISTING MCC-1 IS MANUFACTURED BY SIEMENS-FURNAS STYLE NO. 95BSH8Z4W002.

KEY NOTES:

- CONTRACTOR SHALL UTILIZE THE EXISTING SPARE CUBICLES IN MCC-1 TO FEED THE NEW LOADS. PROVIDE AND INSTALL NEW COMPATIBLE CIRCUIT BREAKERS AS SHOWN. CONTRACTOR SHALL FIELD DETERMINE, SUPPLY AND INSTALL ANY ADDITIONAL COMPONENTS (BUCKET ASSEMBLY, STABS, DOOR, ETC.) AS REQUIRED FOR A FULLY FUNCTIONAL SYSTEM.
- CONTRACTOR SHALL COORDINATE TERMINATION OF CONTROL CONDUCTORS IN THE RTU ENCLOSURE WITH INTEGRATOR.

Owner: SUPERIOR ROCK CREEK WWTF										Computed By: R. LORENZ				
Project Description: ANAEROBIC ZONE IMPROVEMENTS										Date: 8/20/2024				
Title: MCC-1 LOAD CALCULATIONS										Checked By: R. LORENZ				
Project Number: 50161727										Date: 8/20/2024				
Bus Name: MCC-1														
Copy Load Study														
EQUIPMENT NAME	LOAD TYPE	LOAD (HP/KVA)	STEP	PF	DEM FACT	CONNECTED			RUNNING					
						KW-C	KVAR-C	KVA-C	KW-R	KVAR-R	KVA-R			
AM-1 AERATION MIXER	MOTOR	7.50		0.83	1.00	6.22	4.2	7.5	6.2	4.2	7.5			
AM-2 AERATION MIXER	MOTOR	7.50		0.83	1.00	6.22	4.2	7.5	6.2	4.2	7.5			
AM-3 AERATION MIXER	MOTOR	7.50		0.83	1.00	6.22	4.2	7.5	6.2	4.2	7.5			
AM-4 AERATION MIXER	MOTOR	7.50		0.83	1.00	6.22	4.2	7.5	6.2	4.2	7.5			
SP-1 SCUM PUMP	AFD	5.00		0.95	1.00	5.90	1.9	6.2	5.9	1.9	6.2			
AC-1 AIR COMPRESSOR	MOTOR	5.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
AC-2 AIR COMPRESSOR	MOTOR	5.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
AB-3 AERATION BLOWER	AFD	50.00		0.95	1.00	51.20	16.8	53.9	51.2	16.8	53.9			
GRIT PUMP-1	MOTOR	5.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
GRIT PUMP-2	MOTOR	5.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
GRIT CLASSIFIER	MOTOR	10.00		0.84	1.00	8.29	5.4	9.9	8.3	5.4	9.9			
SF-1 SUPPLY FAN	MOTOR	0.75		0.65	1.00	0.73	0.8	1.1	0.7	0.8	1.1			
SF-2 SUPPLY FAN	MOTOR	0.75		0.65	1.00	0.73	0.8	1.1	0.7	0.8	1.1			
POWER PANEL HPB	KVA	40.00		0.80	1.00	32.00	24.0	40.0	32.0	24.0	40.0			
LIGHTING PANEL LPB	KVA	37.50		0.80	1.00	30.00	22.5	37.5	30.0	22.5	37.5			
SF-3 SUPPLY FAN	MOTOR	0.75		0.65	1.00	0.73	0.8	1.1	0.7	0.8	1.1			
SF-4 SUPPLY FAN	MOTOR	0.75		0.65	1.00	0.73	0.8	1.1	0.7	0.8	1.1			
AB-4 AERATION BLOWER	MOTOR	50.00		0.87	1.00	39.68	22.5	45.6	39.7	22.5	45.6			
AWT-3 LIFT PUMP	AFD	15.00		0.95	1.00	16.40	5.4	17.3	16.4	5.4	17.3			
NEW EAST RECIRC PUMP	MOTOR	20.00		0.81	1.00	16.04	11.6	19.8	16.0	11.6	19.8			
NEW WEST RECIRC PUMP	MOTOR	20.00		0.81	1.00	16.04	11.6	19.8	16.0	11.6	19.8			
AWT-2 LIFT PUMP	MOTOR	15.00		0.83	1.00	12.16	8.2	14.7	12.2	8.2	14.7			
NEW ANAEROBIC ZONE 1 MIXER 2110	MOTOR	6.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
NEW ANAEROBIC ZONE 1 MIXER 2120	MOTOR	6.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
NEW ANAEROBIC ZONE 2 MIXER 2210	MOTOR	6.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
NEW ANAEROBIC ZONE 2 MIXER 2220	MOTOR	6.00		0.82	1.00	4.24	3.0	5.2	4.2	3.0	5.2			
TOTAL BUS LOADS									289.4	173.7	337.5	289.4	173.7	337.5
CONNECTED FLA						423.6			P.F.	0.857				
RUNNING FLA						423.6			P.F.	0.857				

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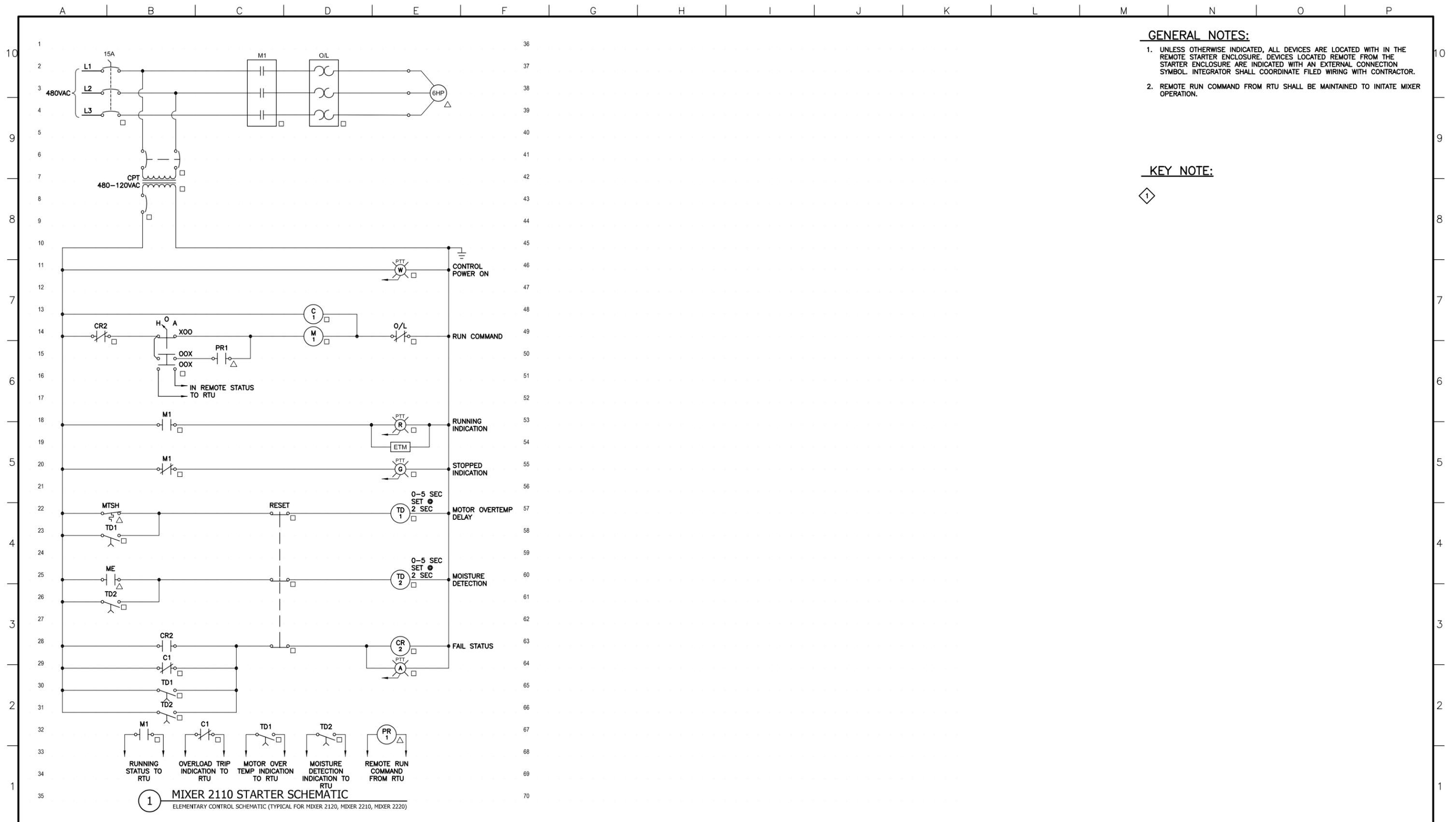
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SUPERIOR METROPOLITAN DISTRICT NO. 1
 SUPERIOR, COLORADO
 ROCK CREEK WWTF AERATION BASINS
 ANAEROBIC ZONE EXPANSION

ELECTRICAL
 ONE-LINE DIAGRAM
 DATE: 8/20/24
 PROJECT NUMBER: 50161727
 REVISION NO. B
 DRAWING NUMBER: E-02



- GENERAL NOTES:**
- UNLESS OTHERWISE INDICATED, ALL DEVICES ARE LOCATED WITH IN THE REMOTE STARTER ENCLOSURE. DEVICES LOCATED REMOTE FROM THE STARTER ENCLOSURE ARE INDICATED WITH AN EXTERNAL CONNECTION SYMBOL. INTEGRATOR SHALL COORDINATE FILED WIRING WITH CONTRACTOR.
 - REMOTE RUN COMMAND FROM RTU SHALL BE MAINTAINED TO INITATE MIXER OPERATION.

KEY NOTE:

①

1 MIXER 2110 STARTER SCHEMATIC
ELEMENTARY CONTROL SCHEMATIC (TYPICAL FOR MIXER 2120, MIXER 2210, MIXER 2220)

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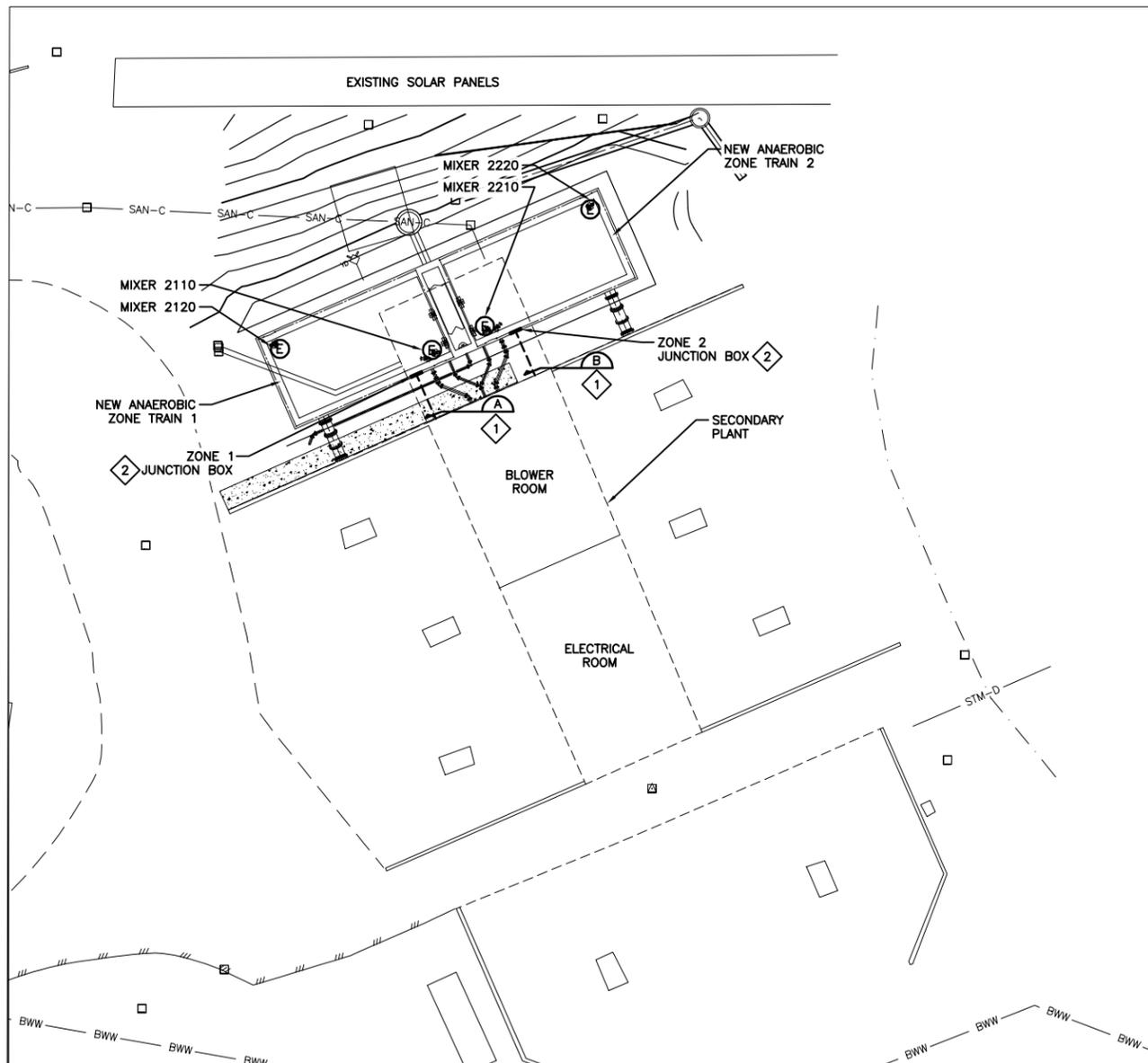
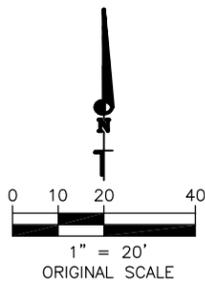
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ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

ELECTRICAL

SCHEMATIC

DATE: 8/20/24
PROJECT NUMBER: 50161727
REVISION NO. B
DRAWING NUMBER **E-03**
SHEET NUMBER



PLAN
ENLARGED SITE PLAN
SCALE: 1"=20'-0"

GENERAL NOTES:

1. ALL UTILITIES SHOWN ARE APPROXIMATE. CONTRACTOR SHALL OBTAIN PUBLIC AND PRIVATE UTILITY LOCATES TO VERIFY UTILITY LOCATIONS. POTHOLE ALL UTILITY CROSSINGS PRIOR TO CONSTRUCTION.
2. CONTRACTOR SHALL ROUTE CONDUITS TO BEST SUIT FIELD CONDITIONS. CONTRACTOR SHALL PROVIDE HAND HOLES AND JUNCTION BOXES AS REQUIRED FOR A COMPLETE INSTALLATION.
3. CONDUIT SIZES SHOWN FOR DUCT BANKS ONLY. REFER TO ONE-LINES FOR OTHER CONDUIT SIZES.
4. SPARE CONDUITS SHALL BE CAPPED OFF WITH PULL STRING.

KEY NOTES:

- ① REFER TO DETAIL 3 & 5/E-06 FOR ADDITIONAL INFORMATION.
- ② REFER TO DETAIL 6/E-07 FOR ADDITIONAL INFORMATION.

BURIED CONDUIT SCHEDULE					
NO.	NAME	FROM	TO	SIZE	TYPE
1	P102, P103	MIXER 2110 STARTER, MIXER 2120 STARTER	ZONE 1 JUNCTION BOX	2"	PVC
2	C100, C101	MIXER 2110 STARTER, MIXER 2120 STARTER	ZONE 1 JUNCTION BOX	2"	PVC
3	SPARE	INSIDE BUILDING	ZONE 1 JUNCTION BOX	2"	PVC
4	P106, P107	MIXER 2210 STARTER, MIXER 2220 STARTER	ZONE 2 JUNCTION BOX	2"	PVC
5	C102, C103	MIXER 2210 STARTER, MIXER 2220 STARTER	ZONE 2 JUNCTION BOX	2"	PVC
6	SPARE	INSIDE BUILDING	ZONE 2 JUNCTION BOX	2"	PVC



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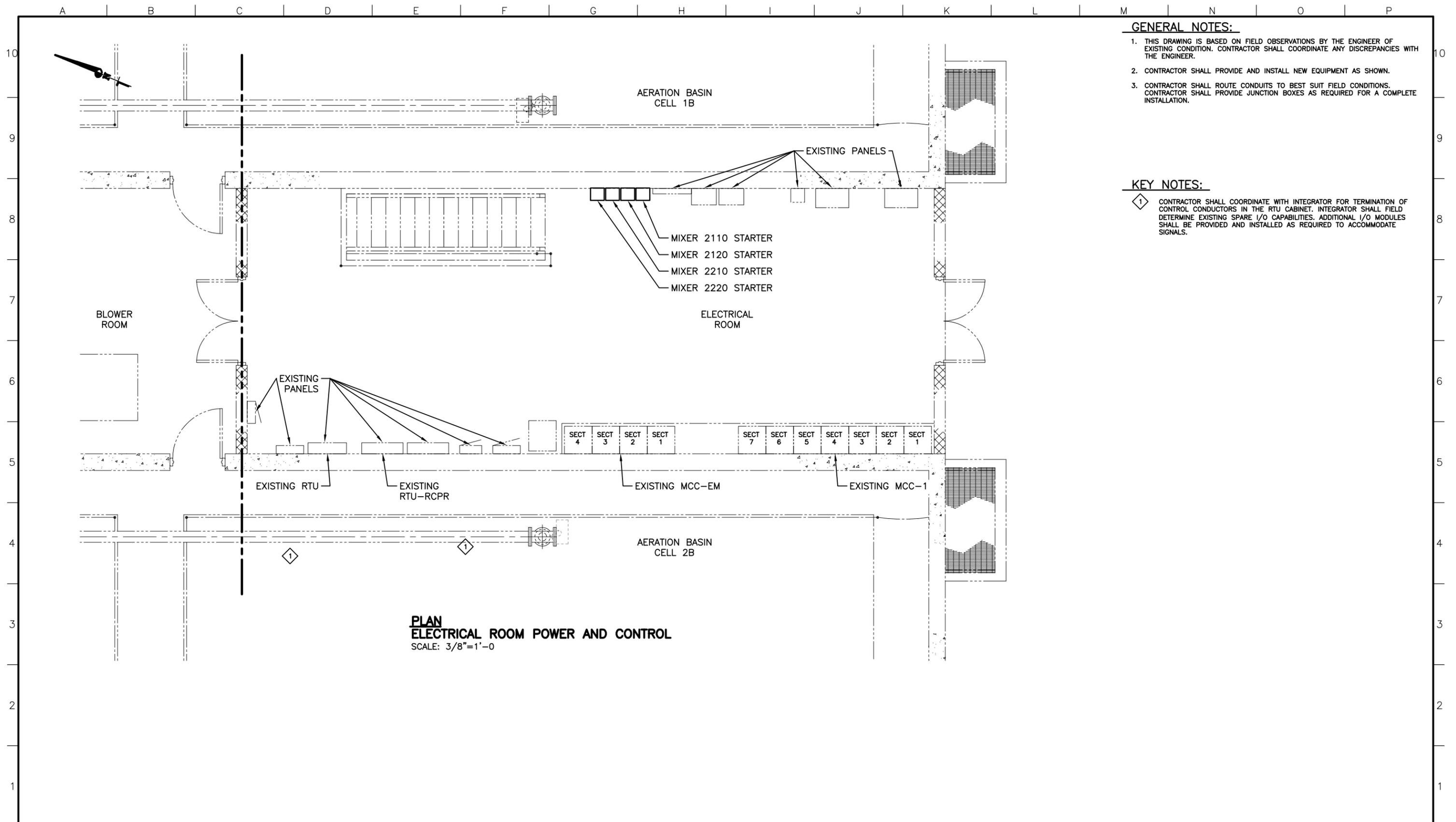
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SUPERIOR, COLORADO

ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

ELECTRICAL

ENLARGED SITE PLAN

DATE: 8/20/24
PROJECT NUMBER: 50161727
REVISION NO. B
DRAWING NUMBER
E-04
SHEET NUMBER



- GENERAL NOTES:**
1. THIS DRAWING IS BASED ON FIELD OBSERVATIONS BY THE ENGINEER OF EXISTING CONDITION. CONTRACTOR SHALL COORDINATE ANY DISCREPANCIES WITH THE ENGINEER.
 2. CONTRACTOR SHALL PROVIDE AND INSTALL NEW EQUIPMENT AS SHOWN.
 3. CONTRACTOR SHALL ROUTE CONDUITS TO BEST SUIT FIELD CONDITIONS. CONTRACTOR SHALL PROVIDE JUNCTION BOXES AS REQUIRED FOR A COMPLETE INSTALLATION.

- KEY NOTES:**
1. CONTRACTOR SHALL COORDINATE WITH INTEGRATOR FOR TERMINATION OF CONTROL CONDUCTORS IN THE RTU CABINET. INTEGRATOR SHALL FIELD DETERMINE EXISTING SPARE I/O CAPABILITIES. ADDITIONAL I/O MODULES SHALL BE PROVIDED AND INSTALLED AS REQUIRED TO ACCOMMODATE SIGNALS.

PLAN
ELECTRICAL ROOM POWER AND CONTROL
 SCALE: 3/8"=1'-0"

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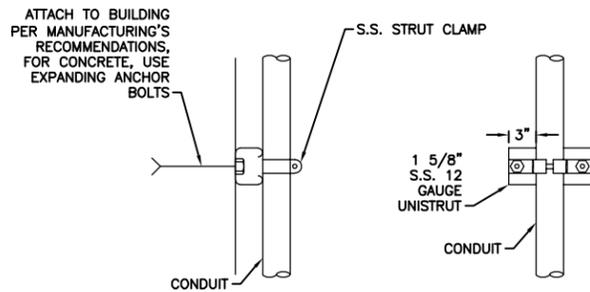
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ROCK CREEK WWTF AERATION BASINS
ANAEROBIC ZONE EXPANSION

ELECTRICAL

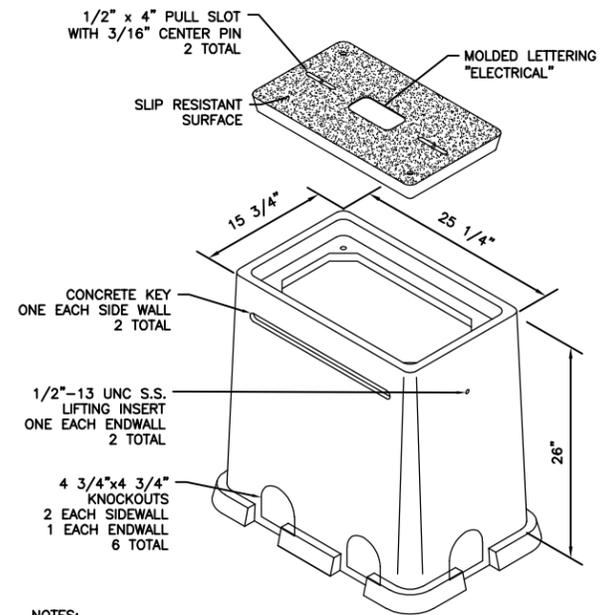
ELECTRICAL ROOM PLAN

DATE: 8/20/24
 PROJECT NUMBER: 50161727
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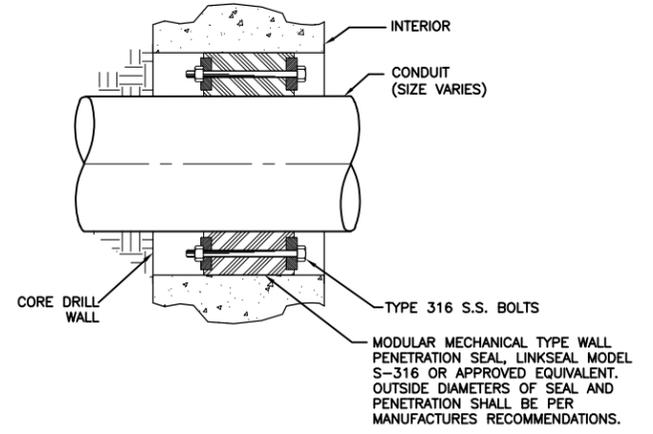
- NOTES:
1. SEE PLAN AND SECTION DRAWINGS FOR CONDUIT SIZES. CONDUITS
 2. SHALL BE MOUNTED TO BEST SUIT FIELD CONDITIONS.
 3. ALL HARDWARE SHALL BE 316 STAINLESS STEEL.

1 CONDUIT SUPPORT DETAIL
NO SCALE



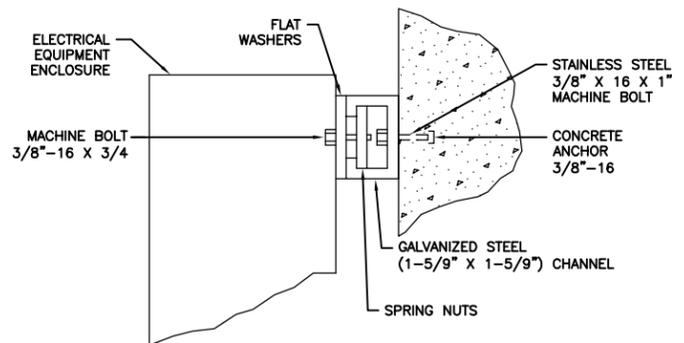
- NOTES:
1. POLYMER CONCRETE FRAME AND NON-SKID COVER FOR STRENGTH. FLARED AT BASE TO PROVIDE ADDITIONAL WORK SPACE.

2 ELECTRIC HAND HOLE PULL BOX
NO SCALE



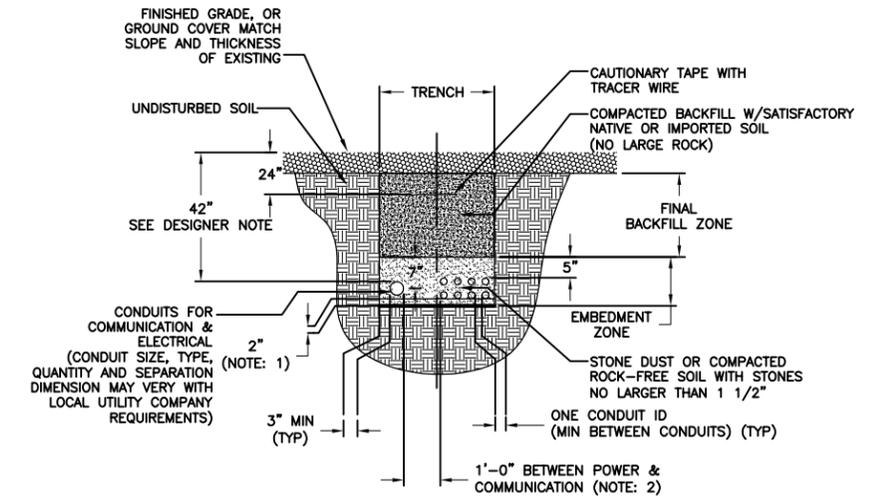
- NOTES:
1. PROVIDE EXPANSION/DEFLECTION FITTINGS SUITABLE FOR DIRECT-BURY (THOMAS & BETTS OR EQUAL) FOR CONDUITS ON THE EXTERIOR OF THE STRUCTURE PENETRATION.

3 MODULAR SEAL CONDUIT PENETRATION
NO SCALE



4 ENCLOSURE MOUNTING DETAIL
NO SCALE

- NOTE:
1. THE BOTTOM OF THE TRENCH MUST BE FREE OF ROCK, CINDERS OR SHARP OBJECTS.
 2. SEPARATION BETWEEN ELECTRICAL CONDUITS AND COMMUNICATION CONDUITS SHALL BE 12" MINIMUM. GREATER SEPARATION SHALL BE MAINTAINED WHERE PRACTICAL. LOCAL COMPANIES MAY REQUIRE GREATER GREATER SEPARATION. THIS SHOULD BE DETERMINED IN ADVANCED BY THE SUBCONTRACTOR.
 3. THE BACKFILLED TRENCH SHALL BE FREE OF PEAT, MARL, HIGHLY PLASTIC CLAY (CH PER ASTM D-2487), OR OTHER UNSUITABLE MATERIAL SUCH AS TRASH, DEBRIS, BRUSH, FROZEN MATERIAL OR ICE.
 4. PLACE EMBEDMENT ZONE MATERIAL IN 3 OR MORE LIFTS AS SHOWN AND TAMP TO ELIMINATE VOIDS AND ASSURE FULL CONTACT WITH THE CONDUIT PERIMETER.
 5. PLACE FINAL BACKFILL ZONE MATERIAL IN 6-INCH LIFTS AND COMPACT WITH MULTIPLE PASSES OF A MACHINE TAMPER, ROLLER, OR VIBRATORY EQUIPMENT (FOR USE ON SAND AND GRAVEL ONLY) THAT IS SPECIFICALLY DESIGNED FOR SOIL COMPACTION. COMPACT UNTIL VOIDS ARE ELIMINATED AND THE COMPACTED SURFACE NO LONGER VISIBLY YIELDS BENEATH THE COMPACTION EQUIPMENT.
 6. ALL CONDUITS SHALL BE BURIED A MINIMUM OF 42" BELOW GRADE TO TOP OF CONDUIT.



5 DIRECT BURIED CONDUIT DETAIL
NO SCALE

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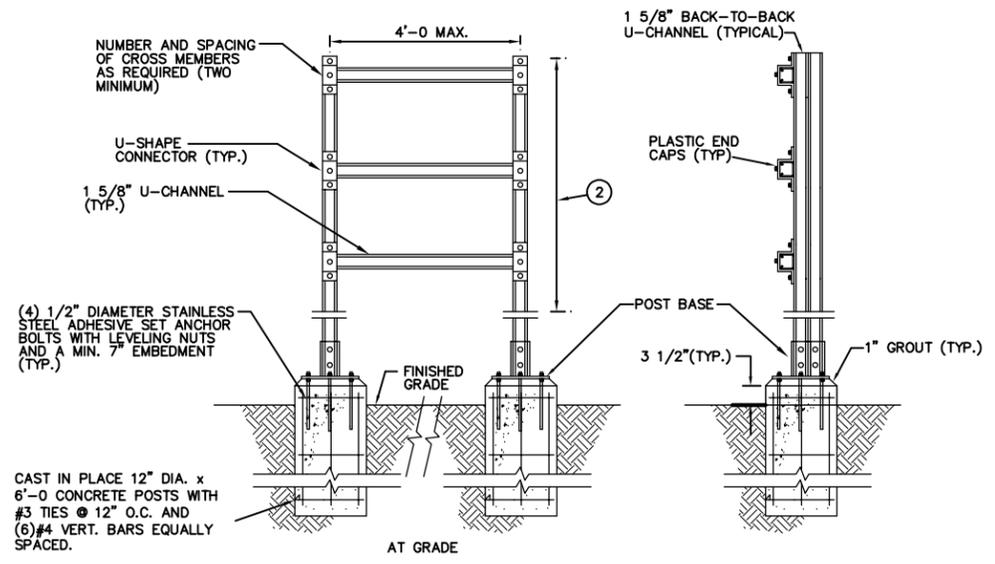
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SUPERIOR METROPOLITAN DISTRICT NO. 1 SUPERIOR, COLORADO
ROCK CREEK WWTF AERATION BASINS ANAEROBIC ZONE EXPANSION

ELECTRICAL
ELECTRICAL DETAILS

DATE: 8/20/24
PROJECT NUMBER: 50161727
REVISION NO. B
DRAWING NUMBER E-06
SHEET NUMBER



- NOTES:**
- ① EQUIPMENT RACK SHALL BE UTILIZED FOR MOUNTING THE FOLLOWING:
- A. ONE EQUIPMENT ITEM WITH MOUNTING FOOTPRINT GREATER THAN 250 SQUARE INCHES.
 - B. TWO EQUIPMENT ITEMS WITH COMBINED MOUNTING FOOTPRINT GREATER THAN 200 SQUARE INCHES.
 - C. THREE OR MORE EQUIPMENT ITEMS.
- WHERE MULTIPLE EQUIPMENT ITEMS WITH SMALL FOOTPRINT AREAS ARE MOUNTED ON THE RACK, A 1/4" PLATE AS USED IN THE CONTROL STATION MOUNTING STAND DETAIL FOR EQUIPMENT MOUNTING CAN BE UTILIZED SPANNING FROM THE TOP TO THE BOTTOM CROSS MEMBER IN LIEU OF MULTIPLE CROSS MEMBERS.
- ② EQUIPMENT SHALL BE MOUNTED AS FOLLOWS:
- A. EQUIPMENT WITH INDICATION, ADJUSTMENTS, OR OPERATING HANDLES SHALL BE MOUNTED FIVE FEET ABOVE FINISHED GRADE.
 - B. JUNCTION BOXES SHALL BE MOUNTED WITH BOTTOM OF BOXES 18" ABOVE FINISHED GRADE.

6 CHANNEL STRUT EQUIPMENT RACK
NO SCALE

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SUPERIOR METROPOLITAN DISTRICT NO. 1 SUPERIOR, COLORADO

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ANAEROBIC ZONE EXPANSION

ELECTRICAL

ELECTRICAL DETAILS

DATE: 8/20/24
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DRAWING NUMBER E-07
SHEET NUMBER