CITY OF IMPERIAL

WASTEWATER TREATMENT PLANT MODIFICATIONS
COARSE SCREEN INSTALLATION
Bid No. 2014-02

MARCH 2014

PREPARED BY
ALBERT A. WEBB ASSOCIATES
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(951) 686-1070

REGISTERED PROFESSIONAL ENGINEER
SHANE LEE BLOOMFIELD
No. C77436
CIVIL
STATE OF CALIFORNIA

PREPARED FOR

CITY OF IMPERIAL
PUBLIC WORKS DEPARTMENT
420 SOUTH IMPERIAL AVENUE
IMPERIAL, CA 92251
(760) 355-1152

BID INVITATION PACKAGE

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

Bid Package Contents: (In this order please)

1. Notice and Invitation to Bidders;
2. Instructions to Bidders;
3. Bid Form;
4. Bid Bond;
5. List of Proposed Subcontractors;
6. Noncollusion Affidavit;
7. General Conditions;
8. Certificate Regarding Workers' Compensation;
9. Project Contract Execution Document;
10. Detailed Specifications
11. Contract Drawings

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Division 3 - Concrete

Division 5 - Metals

Division 9 - Finishes

Division 11 - Equipment

Division 15 – Mechanical

Division 16 – Electrical

APPENDICES

NOTICE AND INVITATION TO BIDDERS

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

NOTICE IS HEREBY GIVEN that sealed bids for the above project shall be received in the offices of the City Clerk at the City of Imperial at 420 So. Imperial Ave, Imperial, CA 92251, until **2:00 p.m.** Pacific Standard Time, on ***April 22, 2014***. Bids will be publicly opened on ***April 22, 2014*** at **2:05 p.m.** Pacific Standard Time, or as soon thereafter as possible, at the City of Imperial located at 420 So. Imperial Ave., Imperial, CA 92251.

The Contract for the work advertised shall be awarded to lowest responsible bidder. City reserves the right to reject all bids.

A prebid site tour will be conducted on April 15, 2014 at 10:30 a.m.. Bidders attending the site tour shall meet at 420 South Imperial Avenue no later than fifteen (15) minutes prior to the scheduled site tour.

PROJECT DESCRIPTION:

Contractor shall furnish all labor, material, equipment and services to perform and complete all work required for the **Wastewater Treatment Plant – Coarse Screen Installation** as per the Project Specifications. The project will generally include construction of a new screen structure with installation of screening equipment, grating, piping, gates, manholes, sewer pipe, and associated mechanical equipment; excavation of existing clarifier piping and modifications to the existing piping including plug valves and piping, installation of aluminum walkway on the existing Biolac divider wall, sewer by-pass during construction of screen structure, electrical modifications, general site work and electrical work; and all incidental work as required by the Specifications and Construction Drawings. Bid packages (CDs) are available at City Hall, 420 South Imperial Avenue, Imperial CA 92251, upon payment of a $35.00 non-refundable fee ($45.00 if mailed).

CONTRACTOR'S LICENSE:

Contractor must have a California State Contractor's Class "A" license. A City of Imperial business license is required prior to start of project.

A bid submitted by any contractor not properly licensed shall be considered non-responsive and will be rejected.

PREVAILING WAGE RATES:

Not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which this contract is to be performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in Chapter 1 (commencing with Section 1720) Part 7, Division 2 of the Labor Code, shall be paid to all workers employed on this public work. Statutory provisions for penalties for failure to pay prevailing wages will be enforced. A copy of the applicable rate of per diem wages is on file in the office of the City Clerk, 420 South Imperial Avenue, Imperial, California.

PAYMENT BOND:

If the successful bid is in excess of $25,000, the successful bidder shall be required to post a payment bond in the amount of the bid in accordance with California Civil Code Section §3247.

RETENTION:

The City shall retain five (5%) percent of the Contract price. The retention shall be released (with the exception of one hundred fifty percent of any disputed amount) within sixty days after the date of completion of the work. The Contractor may substitute securities in place of the retained funds withheld by the City. Alternatively, an escrow agreement, in the form prescribed under Ca. Pub. Cont. Code § 22300, may be used by Contractor.

MISCELLANEOUS:

All inquiries regarding this project should be directed to:

City of Imperial
Jackie Loper – Public Services Director
420 South Imperial Avenue
Imperial, California 92251
760-427-4238

THE CITY OF IMPERIAL

By: Marlene Best, City Manager

INSTRUCTIONS TO BIDDERS

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

1. Explanations to Bidders

(a) Any explanation desired by a bidder regarding the meaning or interpretation of the Invitation for Bids, including drawings, specifications, prior approvals, etc., must be requested in writing no later than 5 calendar days before the bid deadline. Any interpretation made will be in the form of an addendum to the Invitation for Bids and will be furnished to all prospective bidders. Receipt of Addenda by the bidder must be acknowledged in the space provided on the Bid Form or by letter or transmittal received before the time set for opening of sealed bids. Verbal explanations or instructions given before the award of the contract will not be binding.

(b) All questions regarding the Invitation for Bids shall be in writing and directed to:

City of Imperial
Jackie Loper – Public Services Director
420 South Imperial Avenue
Imperial, California 92251
760-427-4238

2. Conditions Affecting the Work

(a) Before submitting a bid, each bidder must (1) examine the bid and contract documents thoroughly, (2) visit the site to familiarize himself with local conditions that may in any manner affect cost, progress or performance of the work (**Optional**), (3) familiarize himself with federal, state and local laws, ordinances, rules and regulations that may in any manner affect cost, progress or performance of the work; and (4) study and carefully correlate bidder's observations with the bid and contract documents. Failure to do so will not relieve bidders from responsibility for estimating properly the difficulty or cost of successfully performing the work. The City will assume no responsibility for any understanding or representations concerning conditions made by any of its officers or agents prior to the execution of the contract, unless included in the bid or contract documents.

(b) The submission of a bid will constitute an incontrovertible representation by the Bidder that it has complied with every requirement of the request for bids and that the bid and contract documents are sufficient in scope and detail to indicate and convey understanding of all terms and conditions for

performance of the work.

3. Bidder's Qualifications

(a) Contractor must have a California State Contractor's Class "A" license to perform the work. Any bid submitted by a contractor not properly licensed shall be considered non-responsive and will be rejected.

4. Bid Guaranty

(a) The bid guaranty shall be in the form of a bid bond, certified check, or cashier's check, payable to the order of the City of Imperial, in an amount not less than 10% of the Bid. If the bid guaranty is in the form of a bond it must be of the type included in this bid package. Any bid bond shall be executed by a corporate surety acceptable to the City and authorized to issue such surety bond in the State of California. Bid guaranties, other than bid bonds, will be returned (1) to unsuccessful Bidders as soon as practicable after the opening of bids, and (2) to the successful Bidder upon execution and delivery of all contract documents. However, the City reserves the right to retain the bid guaranty of the second lowest qualified Bidder until the lowest qualified Bidder executes and delivers all required contract documents to the City or until 60 calendar days after bid opening, whichever occurs first.

(b) Failure to furnish a bid guaranty in the proper form and amount, by the time set for the receipt of bids, shall be cause for rejection of the bid.

(c) If the successful Bidder, upon acceptance of its bid by the City fails to execute and deliver all contract documents within 10 calendar days after receipt of City's Notice of Award, the successful Bidder's bid guaranty shall be retained by the City as liquidated damages. Such failure on the Bidder's part to execute and deliver those documents will cause substantial damage to the City, including delay in its construction program, which damage is not easily reduced to monetary terms and, therefore, the full amount of the bid guaranty is properly considered to be liquidated damages.

5. Preparation of Bids

(a) Bids shall be submitted on the forms furnished, or copies thereof, and must be manually signed. All blank spaces shall be filled in. If erasures or other changes appear on the forms, each erasure or change must be initialed by the person signing the bid. Telephonic or fax bids will not be considered.

(b) Substitutions for specified materials will not be considered without prior approval.

(c) Modifications of bids already submitted will be considered if received at the office designated in the invitation for bids by the time set for receipt of bids. Telephonic or fax modifications will not be considered.

(d) Discrepancies between words and figures shall be resolved in favor of words.

(e) Discrepancies between the indicated sum of any column of figures and the correct sum thereof shall be resolved in favor of the correct sum.

6. Submission of Bids

(a) Bids must be sealed, marked, and addressed as indicated below. Failure to do so may result in a premature opening of, or a failure to open, such bid, thereby eliminating that Bidder from consideration. If the bid is mailed, the sealed envelope containing the bid should be enclosed in another envelope addressed as indicated below.

(b) All bids shall be received no later than **2:00 p.m.** Pacific Standard Time, on ***April XX, 2014*** hand-delivered or mailed, addressed to:

Debra Jackson, City Clerk
City of Imperial
420 South Imperial Avenue
Imperial, California 92251

(c) The envelope containing the original copy of the bid must be sealed, marked, and addressed as follows:

(1) Name and address of Bidder

(2) Marked in the lower left-hand corner of the envelope:

CITY OF IMPERIAL, WASTEWATER TREATMENT PLANT – COARSE SCREEN INSTALLATION – BID NO. 2014-02

(d) The original bid shall consist of those documents listed below. The original document shall be returned with the bid.

(1) Bid Form;

(2) List of Proposed Subcontractors;

(3) Bid Bond;

(4) Noncollusion Affidavit; and

(5) Contractor's Certificate Regarding Workers' Compensation

7. Late Bid, Modification or Withdrawal of Bid by Bidder

(a) Any bid received by the City after the exact time specified for receipt will be returned unopened.

(b) Any modification or withdrawal of bids must be made in writing and is subject to the same condition as in (a) above. A bid may be withdrawn by written or transmittal request received from a Bidder prior to the time set for opening bids. A bid may also be withdrawn in person by a Bidder or the Bidder's authorized representative, provided the representative's identity is made known and the representative signs a receipt for the bid, but only if the withdrawal is made prior to the time set for opening bids.

8. City Modifications Prior to Date Set for Opening Bids

The City may revise or amend the bid or contract documents, including the specifications and drawings, prior to the date set for opening bids. Such revisions and addenda, if any, will be announced by addenda to the Invitation for Bids. If the revisions and addenda are of a nature which require material changes in the bid, the date set for opening bids may be postponed by such number of days as in the opinion of the City will enable Bidders to revise their bids. In such a case, the addendum will include an announcement of the new date and time for opening bids.

9. Public Opening of Bids

Bids will be publicly opened at the time set for opening in the Notice to Bidders. Their content will be made public for the information of Bidders and others interested, who may be present either in person or by representative.

10. Award of Contract

(a) Award of contract will be made to the low responsible Bidder whose bid, conforming to the Invitation for Bids, is most advantageous to the City, price and other factors considered.

(b) The City Council may, when in its interest, reject any or all bids.

(c) The City may accept any item or combination of items of a bid, unless precluded by the Invitation for Bids or the Bidder includes in its bid a restrictive limitation.

11. Bonds and Insurance

(a) If the successful bid is in excess of $25,000, the bidder to whom the contract is awarded shall furnish a Payment Bond on forms approved by the City, executed by a corporate surety acceptable to the City and authorized to issue such surety bonds in the State of California. The Payment Bond shall be in an amount equal to 100% of the Contract Price. The entire cost of bond shall be borne by the successful Bidder.

(b) The successful Bidder shall furnish a Performance Bond on forms approved by the City, executed by a corporate surety acceptable to the City, and authorized and admitted to issue surety bonds in California. The Performance Bond shall be in an amount equal to 100% of the Contract Price. The entire cost of the Performance Bond shall be borne by the successful Bidder.

(c) The successful Bidder shall deliver to the City certification attesting to the fact that the required policies of insurance have been obtained by the Bidder to the limits described in section 5.1.1 of the *General Conditions (pg GC-3)*.

(d) The signed contract, required bonds and certificates of insurance shall be delivered to the City within 10 calendar days after receipt by Bidder of City's Notice of Award.

12. Subcontractors

(a) Each Bidder in its bid shall set forth the following:

(1) The name and location of the place of business of each subcontractor whom it intends to use to perform work or labor, or render service to the Bidder in or about construction of any work, in an amount in excess of 0.5% of the Base Bid. (California law forbids the substitution of subcontractors on public works projects, such as this project, except under very narrow and limited circumstances.)

(2) The portion of the work which will be done by each such proposed subcontractor, if the Bidder is awarded the Contract.

(b) Each Bidder shall furnish such information in substantially the form set forth in the Invitation for Bids. If no subcontractors are to be used, other than within the 0.5% limit referred to above the Bidder shall state "None" on the form.

(c) Each proposed subcontractor must complete a Subcontractor’s Experience Statement, which shall be attached to the List of Proposed Subcontractors in order for the bid to be considered complete.

13. Noncollusion Affidavit

Each Bidder shall include a noncollusion affidavit with its bid in substantially the form set forth in the Invitation for Bids.

14. Permits and Fees

The Bidder's attention is called to the requirements of the General Conditions regarding the acquisition of and payment for permits, licenses and fees related to the work of this project. All such acquisitions and payments are the sole responsibility of the Contractor. It is the sole responsibility of the Bidder to contact agencies or utilities having jurisdiction over the project to ascertain the extent of permits and fees required and the cost thereof, and to include all such costs in its bid.

15. Prevailing Wage Rates

Not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which this contract is to be performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in Chapter 1 (commencing with Section 1720) Part 7, Division 2 of the Labor Code, shall be paid to all workers employed on this public work. Should the prevailing wage rate be increased, decreased, or eliminated a corresponding adjustment shall be made to the Contract Price which shall reflect the effect of that change in or elimination of the prevailing wage rate. A copy of the applicable rate of per diem wages is on file in the office of the City Clerk, 420 South Imperial Avenue, Imperial, California.

The successful Bidder must also comply with statutory requirements relating to certified copies of payroll and maintenance records, and availability for inspection of same. Successful Bidder must comply with statutory requirements relating to employment of apprentices.

16. Construction Schedule

1. After the Contract Documents are executed, the City will give the Contractor notice to proceed. After this notice is given, all contract construction work shall be completed and the screening unit shall be field tested and operational within **180 (one-hundred and eighty) calendar days**. The Contractor will be liable for damages for any inexcusable delay beyond this period. Liquidated damages for such delay shall be $1,000 per working day for each day past the substantial completion date.

2. Due to the expected delivery lead time of the stand-by diesel generator, installation and testing of the generator; final project cleanup; completion of all final project "punch list" items; preparation and acceptance of O&M manuals;

submittal of all as-built Record Drawings and Certifications; and completion of all miscellaneous contract requirements other than those specified above, shall be completed within **210 (two-hundred and ten) calendar days.** Final acceptance testing shall not commence until the diesel generator has been installed and is operational.

17. Debarment of Contractors and Subcontractors

In accordance with the provisions of the Labor Code, contractors or subcontractors may not perform work on a public works project with a subcontractor who is ineligible to perform work on a public project pursuant to Section 1777.1 or Section 1777.7 or the Labor Code. Any contract on a public works project entered into between a contractor and a debarred subcontractor is void as a matter of law. A debarred subcontractor may not receive any public money for performing work as a subcontractor on a public works contract. Any public money that is paid to a debarred subcontractor by the Contractor for the Project shall be returned to the City. The Contractor shall be responsible for the payment of wages to workers of a debarred subcontractor who has been allowed to work on the Project.

BID FORM

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

To: City Of Imperial
Public Works Department
420 South Imperial Avenue
Imperial, California 92251

In response to the Invitation for Bids, the undersigned Bidder hereby proposes to furnish all labor, material, equipment and services and perform and complete all work required for the **Coarse Screen Installation** Project as described in the Plans and Specifications.

Performance shall include all work necessary to complete the Project in strict accordance with the Contract and for the price(s) to be specified by the Bidder below, including all applicable taxes.

Bidder certifies that it has examined and is fully familiar with all of the provisions of the Invitation for Bids and any Addenda thereto; that it is submitting this Bid in strict accordance with the Instructions to Bidders; and that it has carefully reviewed the accuracy of all statements attached to this Bid.

Bidder certifies that it has visited and examined the work site (Optional), and is satisfied with the nature and location of all work, the general and local conditions to be encountered in the performance of the work, the requirements of the Contract and all other matters which can in any way affect the work or the cost thereof. Bidder further certifies that Bidder has performed such tests deemed necessary for the preparation of this bid.

Bidder agrees that this Bid constitutes a firm offer to the City which cannot be withdrawn by Bidder for 60 calendar days from the date of actual opening of bids. If awarded the Contract, Bidder agrees to execute and deliver to the City within 10 calendar days after receipt of City's Notice of Award, the applicable Construction Contract form and the required Payment Bond, Certificates of Insurance, and any other required Contract Documents.

BIDDING SCHEDULE

COARSE SCREEN INSTALLATION

CITY OF IMPERIAL

Item No.	Description	Unit Price	Total Item Price
1	**Mobilization;** including bonds, insurance, potholing of existing utilities prior to commencing construction, site cleanup and restoration, and demobilization(1).	Lump Sum	$ _____*
2	**Demolition and By-Pass;** Removal and legal disposal of existing asphalt, manholes and 15" sewer piping for construction of proposed inlet channel and equipment; relocation of yard piping, abandonment of sewer piping as indicated on the plans, conduit and conductors; tree removal, removal of all excess excavated material as required to meet design grades; finish grading as required to meet design grades as shown on the design drawings and as stated in the Specifications. Preparation and Implementation of Sewage Spill Containment Plan and Sewer Bypass/Phasing Plan as described in the Special Requirements.	Lump Sum	$ _____*
3	**Screen Structure and Equipment;** Construct reinforced concrete screen structure equipped with stairs, handrails, grating, blowers, sluice gate, slide gates, stainless steel manual bar screen, etc. and installation and taxes of screening equipment in Item No. 4 as shown on the design drawings and as stated in the Specifications.	Lump Sum	$ _____*
4	**StepScreen and Wash Press Equipment;** Provide and install one (1) Step Screen Vertical Series (SSV 7300X676x6 by Huber) and one (1) Rotamat WAP Screening Wash Press with controls as shown on the design drawings and as stated in the Specifications.	Lump Sum	$190,000.00
5	**Biolac Walkway;** Install aluminum walkway on existing concrete divider wall of biolac basin, including all aluminum brackets, supports, anchors, grating, handrail, etc. for a complete walkway as shown on the design drawings and as stated in the Specifications.	Lump Sum	$ _____*
6	**Clarifier Pipe Modifications;** Expose existing piping, cut existing piping and dispose of piping removed, install new piping, valves, couplings, valve cans, replace asphalt; all as shown on the design drawing in Appendix B and as stated in the Specifications.	Lump Sum	$ _____*

Item No.	Description	Unit Price	Total Item Price
7	**Site Work**; Including: Fill import/excavation as required to meet design grades; asphalt paving, connection to existing gravity sewer piping, installation of 15" and 24" PVC Sewer pipe, installation of sewer manholes, 24" PVC inlet/outlet piping to proposed inlet channel and connection to existing influent pump station and all other site work as shown on the design drawings and as stated in the Specifications.	Lump Sum	$ _____*
8	**Miscellaneous Work**; Including: hydro-static pressure testing and miscellaneous testing; trench shoring, sheeting, bracing, and dewatering per California Labor Code and OSHA requirements; field start-up, testing, operational demonstrations and operation and maintenance manuals; preparation of SWPPP, and <u>including</u> the cost of all contract work not specifically listed in any other Bid Item (Nos. 1 through 5) herein.	Lump Sum	$ _____*
9	**Field Orders;** The Engineer, with concurrence from the Owner, may make appropriate modifications in the Scope or quantity of contract work to be provided. Bid Item No. 9 shall be utilized for change in work only when written "field ordered" changes are authorized by the Engineer on behalf of the Owner. Should it become necessary to exceed the allowance amount listed in Bid Item No. 9, a formal change shall be made by written Change Order between the Contractor and Owner. Payment for force account work for this contract work will be based on actual quantities furnished, installed, or constructed in accordance with the prices bid for various lump sum or unit price items; or in accordance with prices mutually agreed upon between the Engineer and Contractor, with concurrence from the Owner.	Lump Sum	$25,000*

* Prices include any amount payable by the City for taxes by reason of the Contract

TOTAL BID PRICE – ITEMS 1-9 $ _____*

TOTAL BID PRICE FOR BID SCHEDULE _____

_____ DOLLARS

(DOLLAR AMOUNT IN WRITTEN FORM)

* Prices include any amount payable by the City for taxes by reason of the Contract

The undersigned agrees that these Proposal/Bid Forms constitute a firm offer to the Owner which cannot be withdrawn for the number of Calendar Days indicated in the Notice Inviting Bids from and after the bid opening date, or until a Contract for the Work is fully executed by the Owner and a third party, whichever is earlier. The undersigned also agrees that if there is a discrepancy between the written amount of the Bid Price and the numerical amount of the Bid Price, the written amount shall govern.

Acknowledgement of reading above statement:

By: _____ _____

Signature **Date**

CERTIFIED DATA SHEET

(Supplemental Instructions: The Bidder shall indicate, opposite each item of equipment or material listed below, the name of the manufacturer or supplier of the equipment or material proposed to be furnished under the bid. Awarding of a contract under this bid will not imply approval by the City of Imperial of the manufacturers and/or suppliers listed by the bidder. No substitution will be permitted after award of contract unless equipment or material of the listed manufacturer or supplier cannot meet the specifications.)

	Item	Manufacturer and Supplier
1.	Step Screen	_____
2.	Washpactor	_____
3.	Plug Valves	_____
4.	Ductile Iron Pipe	_____
5.	PVC Sewer Pipe	_____
6.	Channel Gates	_____

ATTACHMENTS

Attached are the following forms which have been completed by Bidder and made a part of this bid:

1. List of Proposed Subcontractors;

2. Noncollusion Affidavit;

3. Contractor's Certificate Regarding Workers' Compensation

ADDENDA

Bidder also acknowledges receipt of the following Addenda, which Addenda have been considered by Bidder in submitting this Bid (if none, state "None"):

Addenda Nos. _____

CONTRACTOR'S LICENSE

Bidder certifies that Bidder is currently licensed under the California State Contractor's License Law as follows:

Contract License Number	Name of Licensee	Type of License	Issue and Expiration date

COMPLETION TIME

The Project, including its respective components, must be substantially completed within ***One Hundred and Eighty (180) Calendar*** days after the notice to proceed. Substantial completion is defined in the Special Requirements. Bidder certifies that it can complete the Project within this time period.

Submitted by,

BIDDER'S NAME:

_____

By: _____

Title :_____

BIDDER'S BUSINESS ADDRESS:

_____

_____

BIDDER’S TELEPHONE AND FAX NUMBERS:

_____

_____

IF BIDDER IS A CORPORATION:

State and date of incorporation

_____

IF A PARTNERSHIP OR JOINT VENTURE:

Full names of all partners or joint venturers (attach additional pages if necessary)

_____

_____

DIRECTIONS FOR SUBMITTING BIDS:

1. The envelope containing the original of this Bid Form with all attachments must be sealed, marked, and addressed as follows:

   a. Marked in the lower left-hand corner of the envelope:

      The City of Imperial**, Wastewater Treatment Plant – Coarse Screen Installation – BID NO. 2014-02**

   b. Addressed to:

      Debra Jackson, City Clerk
      City of Imperial
      420 South Imperial Avenue
      Imperial, CA 92251

LIST OF PROPOSED SUBCONTRACTORS

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

NAME OF BIDDER: _____

If awarded the Contract, Bidder shall employ the following subcontractors who will perform work or labor, or render service to the Bidder in or about the project, in an amount in excess of 0.5% of the bid lump sum listed on the Bid Form. If no subcontract work is proposed, other than within the 0.5% limit set forth, Bidder shall so state. (Attach additional pages if necessary.)

Names and Addresses of Subcontractors	Description of Work to be Subcontracted

Bidder _____ Date _____
Firm Name

Signed by _____ _____
Name Title

BID BOND

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

(Not required if Certified Check of Cashier's Check accompanies Bid)

KNOW ALL PERSONS BY THESE PRESENTS: That we _____
as Principal, and _____
as Surety, are held and firmly bound unto the City of Imperial, in the sum of $_____ [10% OF THE TOTAL AMOUNT OF THE BID] for the payment of which sum we hereby bind ourselves, our successors, heirs, executors, and administrators, jointly and severally, firmly as set out more fully herein.

The condition of the foregoing obligation is such that, whereas the above principal is about to submit to the City of Imperial a bid for the performance of the work for the above project in compliance with the plans and specifications therefore and pursuant to a published notice inviting bids.

Now, if the bid of the principal is accepted and the work awarded to the principal by the City of Imperial, and if the principal shall fail or neglect to enter into a contract, therefore, in accordance with the provision of said bid and the accompanying Instructions to Bidders and to furnish adequate faithful performance and labor and material surety bonds and certificates of insurance to the satisfaction of the City of Imperial; then the total sum guaranteed by this bond is forfeited to the City of Imperial as liquidated damages.

In the event suit is brought by the City of Imperial and judgment is entered in its favor, the surety shall pay all costs incurred by the City in such suit, including reasonable attorneys' fees to be fixed by the Court, in addition to the above sum.

WITNESS our hands and seals this _____ day of _____, 20 .

(Seal)

By_____ Name/Title_____

(Seal)

NOTE: Signatures of those executing for the surety must be properly acknowledged.

Bond No. _____

NONCOLLUSION AFFIDAVIT

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

(To Be Executed by Bidder and Submitted With Bid)

State of California) ss.
County of _____)
_____, being first duly sworn, deposes and says that he or she is _____ of _____, the party making the foregoing bid, that the bid is not made in the interest of, or on behalf of, any undisclosed person, partnership, company, association, organization, or corporation; that the bid is genuine and not collusive or a sham; that the bidder has not directly or indirectly induced or solicited any other bidder to put in a false or sham bid, and has not directly or indirectly colluded, conspired, connived, or agreed with any bidder or anyone else to put in a sham bid, or that anyone shall refrain from bidding; that the bidder has not in any manner, directly or indirectly, sought by agreement, communication, or conference with anyone to fix the bid price of the bidder of any other bidder, or to fix any overhead, profit, or cost element of the bid price, or of that of any other bidder, or to secure any advantage against the public body awarding the contract of anyone interested in the proposed contract; that all statements contained in the bid are true; and, further, that the bidder has not, directly or indirectly, submitted his or her bid price or any breakdown thereof, or the contents thereof, or divulged information or data relative thereto, or paid, and will not pay, any fee to any corporation, partnership, company association, organization, bid depository, or to any member or agent thereof to effectuate a collusive or sham bid.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

Executed this ____day of _____, 20 at _____.

Signature of:
Bidder, if the Bidder is an Individual,
Partner, if the Bidder is a Partnership,
Officer, if the Bidder is a Corporation
Name_____
Title_____

GENERAL CONDITIONS

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

1.0 PARAGRAPH HEADINGS AND DEFINITIONS

1.1 Paragraph headings in this Contract are for convenience only, and are not to be construed to define, limit, expand, interpret, or amplify the provisions of this Contract. When initially capitalized in this Contract, or amendments hereto, the following words or phrases shall have the meanings specified:

1.2.1 Adjusted Contract Price - The initial Contract Price adjusted for change orders, Force Majeure, termination for convenience or any other reason permitted by this Contract.

1.2.2 Best Efforts - Those efforts which a competent, experienced, and prudent contractor would use to perform and complete the requirements of this Contract in a timely manner, exercising the degree of care, competence, and prudence customarily imposed on a contractor performing similar work in the State of California.

1.2.3 Contract - This agreement, including all referenced documents, between the City of Imperial and Contractor for the performance of the Work, and subsequent written modifications executed by the City and Contractor.

1.2.4 Contractor - The legal entity which executes this Contract with the City to perform the Work.

1.2.5 Contract Manager- The title of the person designated by the City to be its representative with authority to act for and bind the City.

1.2.6 Documentation - Drawings, plans, models, studies, surveys, specifications, reports, design analysis, data, policies, information, work product, proposals, and any other similar documents or material prepared or used in connection with the Work.

1.2.7 Final Completion Date - The date when the Work is completed in accordance with the Contract, including all Punch List Items.

1.2.8 Force Majeure - An act of God, or event beyond the control of a party, including an act or omission of government, act or omission of civil or military authority, strike or lockout, act of a public enemy, war, blockade, insurrection, riot, epidemic, landslide, earthquake, fire, storm, lightning,

flood, washout, or civil disturbance which could not have been avoided through the exercise of reasonable care and prudence.

1.2.9 Price or Contract Price - The total sum to be paid by the City to Contractor for performance of the Work.

1.2.10 Project - Contractor shall furnish all labor, material, equipment and services and perform and complete all work required as per the project specifications.

1.2.11 Project Engineer or Coordinator - The title of the person designated by the City to be its representative with authority to act for the City regarding engineering and construction matters.

1.2.12 Punch List Items - Items of work comprising a part of the Work as set out on a Punch List prepared by the City, with said items to be completed by Contractor consistent with the terms and conditions and scope of the Contract.

1.2.13 Schedule - The time frame for the construction project as established by the City and/or the Contract Documents.

1.2.14 Site - The area where Contractor shall perform the Work.

1.2.15 Work or Scope of Work - All obligations undertaken by Contractor pursuant to the Contract.

2.0 SCOPE OF WORK

Contractor shall perform and complete the Work in a safe manner, and shall supply all personnel, tools, equipment, and material to complete the Work. The scope of work is further established in the following documents: Plans and Specifications**.**

3.0 SCHEDULE

Contractor shall perform and substantially complete the Work within ***One Hundred and Eighty (180) Calendar*** days after the date in the notice to proceed. After execution of this Contract, Contractor shall develop and submit for City's approval, a detailed construction schedule designed to meet City's project schedule. Any abnormal expenses such as premium time or overtime incurred by Contractor to meet the detailed schedule, unless specifically directed or approved by the City in writing, shall be borne by Contractor.

4.0 COMPENSATION AND PAYMENT

The City shall compensate Contractor through progress payments according to percentage of completion and/or milestones, as determined by the City Contract Administrator or as agreed hereafter by the parties. The City shall not be obligated to make final payment(s) until Contractor has submitted to the City written evidence that the Work has been fully completed in accordance with this Contract, and satisfactory evidence that all of Contractor's indebtedness in connection with the Work has been paid or written releases provided of all potential liens arising out of this Contract. Upon receipt of such evidence, the City will record a Notice of Completion in Imperial County. City shall retain 10% of the Contract Price. Contractor may substitute securities or provide an escrow agreement pursuant to California Public Contracts Code section 22300.

5.0 INSURANCE AND BONDS

5.1 Insurance - Contractor agrees to provide insurance in accordance with the requirements set forth herein. If Contractor uses existing coverage to comply with these requirements and that coverage does not meet the requirements, Contractor agrees to modify the existing coverage to do so.

The following coverages will be provided by Contractor and maintained on behalf of the City and in accordance with the following requirements:

5.1.1 Commercial General Liability Insurance - Commercial General Liability Insurance shall be provided on an occurrence form or equivalent. Claims made or modified occurrence forms will not be accepted. Total limits for all coverage shall be no less than $1,000,000 per occurrence and $2,000,000 general aggregate. The aggregate amount shall apply per location. The City and its employees and agents shall be added as additional insured using the Industry Standard form. Coverage shall apply on a primary non-contributing basis in relation to any other insurance or self-insurance, primary or excess, available to the City or any employee or agent of the City. Coverage shall not be limited to the vicarious liability or supervisory role of any additional insured. There shall be no endorsement or modification limiting the scope of coverage for liability arising from explosion, collapse, or underground property damage.

5.1.2 Workers' Compensation/Employers' Liability - Workers' Compensation/ Employers' Liability coverage shall be written on a policy form providing workers' compensation statutory benefits as required by law. Employer's liability limits shall be no less than $1,000,000 per accident or disease. This policy shall waive any right of subrogation with respect to the City, its employees or agents.

5.2 Additional Insurance Provisions - Contractor and the City further agree as follows:

5.2.1 This Section supersedes all other sections and provisions of this Contract to the extent that any other section or provision conflicts with or impairs the provisions of this Section.

5.2.2 Nothing contained in this Section is to be construed as affecting or altering the legal status of the parties to this Contract.

5.2.3 The insurance requirements set forth in this Section are intended to be separate and distinct from any other provision in this Contract and shall be interpreted as such.

5.2.4 All insurance coverage and limits provided pursuant to this Contract shall apply to the full extent of the policies involved, available or applicable. Nothing contained in this Contract or any other agreement relating to the City or its operations limits the application of such insurance coverage.

5.2.5 Requirements of specific minimum coverage features or limits contained in this Section are not intended as a constraint on coverage, or other requirements, or a waiver of any coverage. Specific reference to a given coverage feature is for purposes of clarification only and is not intended by any party to be all inclusive, or to the exclusion of other coverage, or a waiver of any type.

5.2.6 For purposes of insurance coverage only, this Contract will be deemed to have been executed immediately upon any party hereto taking any steps in furtherance of performance of this Contract.

5.2.7 Unless otherwise approved by the City, Contractor's insurance shall be written by insurers authorized to do business in the State of California and with a minimum "Best's" Insurance Guide rating of "A-:VII." Self-insurance will not comply with these insurance specifications.

5.2.8 In the event any policy of insurance required under this Contract does not comply with these requirements or is canceled and not replaced, the City has the right but not the duty to obtain the insurance it deems necessary and any premium paid by the City will be promptly reimbursed by Contractor.

5.2.9 Contractor agrees to provide evidence of the insurance required herein, satisfactory to the City, consisting of certificate(s) of insurance evidencing all of the coverages required and additional insured endorsement to Contractor's liability policies. Certificate(s) are to reflect that the insurer will provide 30 days notice of any cancellation of coverage. Contractor agrees to require its insurer to modify such certificates to delete any exculpatory wording stating that failure of the insurer to mail written notice of cancellation imposes no obligation, and to delete the word "endeavor" with

regard to any notice provisions. Contractor agrees to provide complete certified copies of policies to the City upon request.

5.2.10 Contractor shall provide the City with proof that policies of insurance required herein expiring during the term of this Contract have been renewed or replaced with other policies providing at least the same coverage. Such proof will be furnished prior to the expiration of the coverages.

5.2.11 Any failure on the part of the City or any other additional insured under these requirements to obtain proof of insurance required under this Contract in no way waives any right or remedy of the City or any additional insured, in this or any other regard.

5.2.12 Contractor shall require all subcontractors or other parties hired for this project to provide general liability insurance with coverage identical to that required for Contractor naming the City, its employees and agents as additional insured where applicable. Contractor shall obtain certificates evidencing such coverage and make reasonable efforts to ensure that such coverage is provided as required herein.

Contractor shall require that no contract used by any subcontractor, or other contracts Contractor enters into on behalf of the City, will reserve the right to charge back to the City the cost of insurance required by this Contract. Contractor agrees that upon request, all agreements with subcontractors or others with whom Contractor contracts with on behalf of the City, will be submitted to City for review. Failure of the City to request copies of such agreements will not impose any liability on the City, or its employees.

5.2.13 If Contractor is a limited liability company, general liability coverage must be amended so that the limited liability company and its managers, affiliates, employees, agents, and other persons necessary or incidental to its operation are insured.

5.2.14 Contractor agrees to provide immediate notice to the City of any claim or loss against Contractor that includes the City as a defendant. The City assumes no obligation or liability by such notice, but has the right (but not the duty) to monitor the handling of any claim likely to involve the City.

5.2.15 In the event of any loss that is not insured due to the failure of Contractor to comply with these requirements, Contractor agrees to be personally responsible for any and all losses, claims suits, damages, defense obligations and liability of any kind attributed to the City or its employees as a result of such failure.

5.2.16 Coverage will not be limited to the specific location designated as the address of the project.

5.3 Bonds - Contractor shall furnish the following surety bond with surety acceptable to City.

5.3.1 If the successful bid is in excess of $25,000, the successful bidder shall be required to post a payment bond in the amount of the bid in accordance with California Civil Code Section §3247. This bond shall give labor and material suppliers direct right of action against the surety. Contractor shall furnish the Payment bond on a form acceptable by the City.

5.3.2 Successful Bidder shall post a Performance Bond in the amount of 100% of the Contract Price by a corporate surety authorized and admitted to issue such surety bond in the State of California.

5.4 Sureties

5.4.1 Should any surety upon any bond furnished in connection with this Contract become unacceptable to the City, or should any such surety fail to furnish reports as to its financial condition as may be requested by the City at any time while the bond is in force, Contractor shall promptly furnish such additional surety or alternate bond at Contractor's expense as may be required by the City to protect the interests of the City or of persons supplying labor or material in the performance of this Contract.

5.4.2 Contractor shall keep the sureties informed as to all material matters or changes affecting the project and this Contract.

6.0 INDEMNIFICATION

To the fullest extent permitted by law, Contractor shall defend, indemnify and hold harmless the City, its employees, agents and officials, from any: liability, claims, suits or actions; alternative dispute resolution, losses, expenses, fees, or costs of any kind, whether actual, alleged or threatened; administrative, and regulatory proceedings; and any other costs or expenses of any kind whatsoever without restriction or limitation; so long as such things are in relation to, as a consequence of, arising out of, or in any way attributable actually, allegedly or implied, in whole or in part, to the performance of this Contract. All obligations under this provision are to be paid by Contractor as they are incurred by the City.

Without affecting the rights of the City under any provision of this Contract or this section, Contractor shall not be required to indemnify and hold harmless the City as set forth above for liability attributable to the sole fault of the City, provided such sole fault is determined by agreement between the parties or the findings of a court of competent jurisdiction.

7.0 GENERAL REQUIREMENTS

7.1 Physical Site Conditions - Contractor shall satisfy itself concerning the nature and location of the Work, the general and local conditions, and other restrictions affecting the Work. The failure of Contractor to acquaint itself with any applicable conditions and restrictions shall not relieve it from the responsibility for properly estimating either the difficulties or the costs of successfully performing the Work and completing this Contract, and shall not be grounds for adjusting either the price or the schedule.

7.2 Independent Contractor - Contractor represents that it is fully experienced and properly qualified to perform the Work, is properly licensed in the state where the Work is performed, and is equipped, organized, and financed to perform such Work. The Contractor or a subcontractor of the Contractor shall act as an independent contractor and not as an agent of the City in performing the Work and duties of this Contract.

7.3 Performance Requirements

7.3.1 Best Efforts - Contractor shall use Best Efforts in the performance of this Contract. Contractor shall, to the best of its abilities, cooperate with the City to enable the successful completion of the Work according to the terms of this Contract including, but not limited to, commitment of additional resources, material and personnel, if requested by the City, to assure that the Work is properly performed on time and completed in accordance with the provisions of this Contract.

7.3.2 Quality of Equipment Supplied by Contractor - Contractor shall provide and use only such construction equipment and facilities as are capable of producing the quality and quantity of Work required by this Contract within the time specified herein. Upon written notice from the City or its designated representative, Contractor shall promptly remove from the Site all unsatisfactory construction equipment and facilities furnished or provided by Contractor.

7.4 Precedence of Operating Facilities - Continuity of service of the operating facilities is of the essence. In the event of a conflict of interest between any and all Work and any operating facilities, the operating facilities shall have precedence.

7.5 Responsibility for Work and Material - Contractor shall be responsible for and shall bear all risk of loss of or damage to Work in progress, all Work-related material and equipment delivered to the Site or in transit under Contractor control, until completion and final acceptance of the Work.

8.0 CHANGES

8.1 General - Notwithstanding any other provisions of this Contract to the contrary, the City reserves the right for any reason, without invalidating this Contract or without notice to sureties, to make any changes in the Work including the performance of additional services. Such change shall be made in writing by a City representative, except for emergency conditions, where such change shall be confirmed in writing.

8.2 Price of Change - All change orders shall be accepted by Contractor pursuant to the terms contained in this Contract and Contractor shall promptly proceed to implement such change. Should any change result in an increase or decrease in Price or a change in Schedule, Contractor shall, within 10 calendar days following receipt of the written change order, submit to the City a written proposal which illustrates the price for Contractor to perform the change and the proposed adjustment to the Schedule. Sufficient detail shall be given in the proposal to permit a thorough analysis and evaluation. No claim shall be made by Contractor based solely on the number or volume of changes made.

8.3 Price Adjustment - The price of such change will be agreed upon by the parties. If the parties cannot agree, an adjustment will be determined by the City on the basis of Contractor's reasonable expenditures and savings, including a reasonable allowance for overhead and profit.

8.4 Delegation - Only a City officer, or the designated City representative concerning the Project, may issue and sign written change orders on behalf of the City.

8.5 Contractor Objections - In the event a change requested by the City would, in the opinion of Contractor, affect Contractor’s ability to meet its obligation under the Contract, Contractor will deliver to the City, within 5 calendar days of receipt of the change request, written notice of the fact before accepting such change request. If the City feels such a change is warranted, an appropriate modification to the Contract shall be made before the Contractor is required to proceed.

8.6 Changes by Contractor - The Contractor may propose changes in the specifications for reasons of improved quality, delivery or economy provided such changes do not impair quality or delivery. Such changes must be approved in writing by the City prior to implementation. Approval shall be at the discretion of the City.

9.0 WARRANTY

9.1 Performance and Workmanship - Contractor warrants that the workmanship performed by Contractor and its subcontractors will be performed in accordance with Best Efforts. The warranty period shall be for a period equal to 1 year after the Final Completion Date.

10.0 RETENTION AND ACCEPTANCE OF MATERIAL AND WORKMANSHIP

10.1 Retention - The City shall retain 5% of the Contract price. The retention shall be released (with the exception of 150% of any disputed amount) within 35 days after the date of final completion of the work. Contractor may substitute securities in place of the retained funds withheld by the City. Alternatively, an escrow agreement, in the form prescribed under Ca. Pub. Cont. Code Section 22300, may be used by Contractor.

10.2 Inspection of Work - All Work and materials, both before and after installation, shall be subject to City's inspection, and any deficiencies detected by the City will be addressed by Contractor immediately. The City may take inventory and inspect the Work and witness tests thereon at all reasonable times and places during the progress of the Work. If Contractor covers all or any portion of the Work prior to any inspection or tests as required by the Scope of Work, the cost of any necessary uncovering and replacing shall be borne by Contractor.

10.3 Notice of Completion

10.3.1 When Contractor, in its opinion, has completed the performance of the Work, it shall so notify the City in writing that the Work is completed and ready for final acceptance by the City. Within 10 calendar days after receipt of such written notice, the City shall inspect the Work and advise Contractor of its concurrence.

10.3.2 If the City advises Contractor that the Work is not satisfactorily completed, the City shall at the time of such notice, submit to Contractor, a Punch List of all additions and corrections necessary for the completion of this Contract.

10.3.3 Upon receipt of the Punch List, Contractor shall commence action with respect thereto at no cost to the City. All corrections shall be made within the time period given in the Contract as established in the Project Schedule. Upon completion of such Work, Contractor shall again notify the City in writing that the Work is completed and ready for final acceptance by the City. Within 10 calendar days after receipt of such written notice, the City shall inspect the Work and advise Contractor whether it concurs. The punch List process will continue until the Work is completed to the satisfaction of the City. Contractor shall be obligated to make good, correct or modify any rejected material or workmanship prior to final acceptance of the Work by the City.

10.3.4 If the City concurs that the Work has been completed satisfactorily, the City will record a Notice of Completion with the County of Imperial which will specify the Final Completion Date. Such Notice of Completion shall not be unreasonably withheld.

11.0 FORCE MAJEURE

In the event either party by reason of a Force Majeure is rendered unable to perform its duties under this Contract, then upon the party giving written notice of the particulars and estimated duration of Force Majeure to the other party within 5 calendar days after knowledge of the occurrence of the Force Majeure, the party may have the time for performance of its duties extended for the period equal to the time performance is delayed by the Force Majeure. The effects of the Force Majeure shall be remedied with all reasonable dispatch, and the party giving notice shall use Best Efforts to eliminate and mitigate all consequences. A Force Majeure for which notice has not been given shall be an unexcused delay.

12.0 DELAYS AND EXTENSION OF TIME

Time for performance may be extended by the City because of delays such as Force Majeure, changes, or suspension. Any such extension shall not be grounds for a claim by Contractor for damages or for additional compensation, except as specifically authorized in this Contract. In the event of delay in the performance of the Work not caused by the City or its representatives, whether or not the cause thereof is within the control of Contractor, the City shall be entitled to suspend the applicable portion of the scheduled payments for the period of such delay.

13. 0 TERMINATION FOR CONVENIENCE

13.1 General - The City may, at any time, terminate the Contract or any portion of the Work not then completed by giving Contractor written notice of termination. Upon receipt of notice of termination, Contractor, unless the notice requires otherwise, shall (1) discontinue Work on the date and to the extent specified in the notice, except Work necessary to preserve and protect the Work in progress, (2) place no further orders or subcontracts for material, services, or supplies related to terminated Work, (3) make every reasonable effort to procure termination of all orders, subcontracts, and rental agreements to the extent they relate to performance of Work terminated upon terms satisfactory to the City, and (4) otherwise minimize costs and mitigate damages to the City .

13.2 Compensation - In the event of termination under this Section, there shall be an equitable adjustment to the Contract Price taking into account, among other things (1) decreases for Work not performed, (2) the cost of any work requested by the City from the date of termination.

14.0 TERMINATION FOR CAUSE; NOTICE AND CURE OF DEFAULT

14.1 General - The City may declare this Contract canceled for default by notifying Contractor in writing, should Contractor at any time (1) materially refuse or neglect to meet the Schedule(s), (2) refuse to supply sufficient and appropriately skilled workmen or equipment to perform the Work, (3) become insolvent or unable to meet its payroll or other current obligations.

14.2 Notice of Termination - Prior to termination for cause, the City shall give Contractor written notice describing such default in reasonable detail and demand that Contractor cure such default within 30 calendar days after receipt of such notice of default. If Contractor does not cure the default within 30 calendar days after its receipt of such notice or if the default cannot be cured within such 30 calendar day period and Contractor has not initiated action or proposed a plan within such 30 calendar day period to cure the default within a reasonable period which the City reasonably agrees will cure such default, then the City shall have the right to terminate this Contract.

15.0 LAWS AND REGULATIONS

Contractor and its employees shall at all times comply with all applicable laws, including those relating to wages, hours, discrimination, and safety (including CAL/OSHA).

16.0 EMPLOYEES

16.1 Prevailing Wage Law-

16.1.1 Not less than the general prevailing rate of per diem wages for work of a similar character in the locality in which this Contract is to be performed, and not less than the general prevailing rate of per diem wages for holiday and overtime work fixed as provided in Chapter 1 (commencing with Section 1720) Part 7, Division 2 of the Labor Code, shall be paid to all workers employed on this public work.

16.1.2 Should the prevailing wage rate be increased, decreased, or eliminated a corresponding adjustment shall be made to the Contract Price which shall reflect the effect of that change in or elimination of the prevailing wage rate.

16.2 Payroll Records -

16.2.1 Contractor and its subcontractors shall keep an accurate payroll record, showing the name, address, social security number, work classification, and straight time and overtime hours worked each day and week, and the

actual per diem wages paid to each journeyman, apprentice, worker, or other employee employed by him or her in connection with the Project.

16.2.2 The payroll records shall be certified and shall be available for inspection at all reasonable hours at the principal office of Contractor.

17.0 SAFETY REQUIREMENTS

17.1 General - Contractor shall implement the following general safety precautions:

17.1.1 Safe Work - Contractor shall carry out the Work in a safe manner. Contractor's site representative shall be knowledgeable of all applicable safety rules, regulations and practices that relate to the assigned work. If necessary, a qualified safety representative should be contracted to fulfill this requirement.

18.0 GOVERNING LAW AND VENUE

This Contract shall be interpreted in accordance with the substantive and procedural laws of the State of California.

19.0 AUTHORIZED REPRESENTATIVES AND NOTICES

19.1 Representatives - Prior to commencement of the Work, the City and Contractor shall each designate a representative authorized to act in behalf of each party and shall advise the other party in writing of the name, address and telephone number of such designated representative and shall inform the other party of any subsequent change in such designation.

19.2 Notice and Communications - All communications relating to the day to day activities under this Contract shall be exchanged between the representatives of the City and Contractor. All legal notices and communications required under or related to this Contract shall be in writing, and shall be delivered personally or mailed by certified mail, postage prepaid, return receipt requested, to the representative of the City and Contractor identified below. Notice shall be effective on the date of delivery.

To the City:	To Contractor:
Jackie Loper	_____
Director of Community Dev.	
City of Imperial	_____
420 South Imperial Ave.	
Imperial, CA 92251	_____

A party may change or supplement the addresses given above, or designate additional addresses, for purposes of this Section by giving the other party written notice of the new address in the manner set forth above.

19.3 Unfair Business Practice Claims – In entering into a public works contract or subcontract to supply goods, services, or materials pursuant to a public works contract, the Contractor or subcontractor offers and agrees to assign to the City all rights, title and interest in and to all causes of action it may have under Section 4 of the Clayton Act (15 U.S.C. Sec. 15) or under the Cartwright Act (Chapter 2 (commencing with Section 16700) of Part 2 of Division 7 of the Business and Professions Code), arising from purchases of goods, services, or materials pursuant to the public works contract or the subcontract. This assignment shall be made and become effective at the time the awarding body tenders final payment to the Contractor, without further acknowledgment by the parties.

19.4 Resolution of Claims – Claims of $375,000.00 or less shall be addressed as set forth in California Public Contracts Code §§20104, set seq. In general terms, said process contemplates a meet and confer procedure and non-binding mediation as a precursor to litigation.

19.5 Utilities Relocation – The provisions of Government Code Section 4215 are hereby incorporated by this reference. Said section provides, among other things, that the Contractor will be compensated for costs of locating, repairing damage not due to the failure of the Contractor to exercise reasonable care, and removing or relocating such utility facilities not indicated in the plans and specifications with reasonable accuracy, and for equipment on the Project necessarily idled during such work. Contractor shall not be assessed liquidated damages for delay in completion of the Project when such delay was caused by the failure of the public agency or the owner of the utility to provide for removal or relocation of such utility facilities.

If Contractor discovers utility facilities not identified by City in the contract plans or specifications, Contractor shall immediately notify City and utility in writing.

20.0 ATTORNEYS FEES

If either party to this Contract shall bring any action, claim, appeal, or alternative dispute resolution proceedings, for any relief against the other, declaratory or otherwise, to enforce the terms of or to declare rights under this Contract (collectively, an Action), the losing party shall pay to the prevailing party a reasonable sum for attorneys' fees and costs incurred in bringing and prosecuting such Action and/or enforcing any judgment, order, ruling, or award (collectively, a Decision) granted therein. Any Decision entered in such Action shall provide for the recovery of attorneys' fees and costs incurred in enforcing such Decision. The court or arbitrator may fix the amount of reasonable

attorneys' fees and costs on the request of either party. For the purposes of this paragraph, attorneys' fees shall include, without limitation, fees incurred in the following: (1) postjudgment motions and collection actions; (2) contempt proceedings; (3) garnishment, levy, and debtor and third party examinations; (4) discovery; and (5) bankruptcy litigation. "Prevailing party" within the meaning of this paragraph includes, without limitation, a party who agrees to dismiss an Action on the other party's payment of the sums allegedly due or performance of the covenants allegedly breached, or who obtains substantially the relief it seeks.

21.0 WAIVER

The failure of the City to insist upon strict performance of any of the terms and conditions of this Contract, or to exercise or delay the exercise of any rights or remedies provided by this Contract or by law, or the acceptance of Work or payment for Work shall not release Contractor from any of the responsibilities or obligations imposed by law or by this Contract and shall not be deemed a waiver of any right of the City to insist upon strict performance of this Contract. None of the provisions of the Contract shall be considered waived by either party except when such waivers are agreed upon in writing by the parties.

22.0 ASSIGNMENT

Contractor shall not assign the rights, nor delegate the duties, or otherwise dispose of any right, title, or interest in all or any part of this Contract, or assign any monies due or to become due to Contractor without the prior written consent of the City. Any such approved assignment or delegation shall be for the benefit of, and shall be binding on Contractor, assignee, and all future successors; and shall not relieve Contractor, assignee, or future successors of any duties or obligations. If the City approves any assignment of monies due or to become due to Contractor hereunder, such assignment shall not become effective until at least 30 calendar days after City’s approval.

23.0 ACCEPTANCE

The City will be deemed to have accepted Contractor's performance of the Work when the City officer or manager signing this Contract, or the designated representative of said officer or manager, records a Notice of Completion that the Work is accepted.

24.0 EXECUTION AND EFFECTIVE DATE

This Contract has been executed by the duly authorized officers of the parties and shall be effective as of the date that the **PROJECT CONTRACT EXECUTION DOCUMENT** is signed by the parties.

25.0 PRECAUTIONS ON THE JOB SITE

When the Work involves trenching of more than four feet in depth, Contractor shall promptly, and before the following conditions are disturbed, notify the City, in writing, of any:

25.1 Material that the Contractor believes may be material that is hazardous waste, as defined in Section 25117 of the Health and Safety Code, and that is required to be removed to a Class I, Class II, or Class III disposal site in accordance with provisions of existing law.

25.2 Subsurface or latent physical conditions of Site differing from those indicated.

25.3 Unknown physical conditions at the Site of any unusual nature, different materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract.

Upon receipt of such notice, City shall promptly investigate the conditions, and if it finds that the conditions do materially so differ, or do involve hazardous waste, and cause a decrease or increase in the Contractor's cost of, or the time required for, performance of any part of the work, shall issue a change order under the procedures described in the contract.

In the event that a dispute arises between the City and the Contractor whether the conditions materially differ, or involve hazardous waste, or cause a decrease or increase in the Contractor's cost of, or time required for, performance of any part of the Work, the Contractor shall not be excused from any scheduled completion date provided for by the Contract, but shall proceed with all Work to be performed under the Contract. The Contractor shall retain any and all rights provided either by Contract or by law which pertain to the resolution of disputes and protests between the parties.

CERTIFICATE OF CONTRACTOR REGARDING WORKERS' COMPENSATION

The successful Bidder shall execute the following certificate:

I am aware of the provisions of Section 3700 of the Labor Code which require every employer to be insured against liability for workers' compensation or to undertake self-insurance in accordance with the provisions of that code, and I will comply with such provisions before commencing the performance of the work of this Contract.

Dated: _____ Contractor

By_____

PROJECT CONTRACT EXECUTION DOCUMENT

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

DATE OF CONTRACT:

NAME AND ADDRESS OF CONTRACTOR:

The City of Imperial and Contractor named above hereby mutually agree to perform this Contract in strict accordance with the following designated documents which were a part of the bid or required to be submitted under the Invitation for Bids as a part of the Contract Documents and which are hereby incorporated into this Contract by reference:

CONTRACT DOCUMENTS

1. Notice to Bidders;
2. Instructions to Bidders;
3. Bid Form, with Required Attachments;
4. General Conditions;
5. Specifications;
6. All Addenda to the Contract Documents;
7. Payment and Performance Bonds Submitted by Contractor;
8. Certificates of Insurance Submitted by Contractor; and
9. Certificate Regarding Workers' Compensation.

This Contract, together with all documents and exhibits incorporated herein by reference, constitutes the entire agreement of the parties. All prior or contemporaneous verbal agreements between the parties are revoked by this Contract.

In the event any section, sentence, clause or phrase of the Contract is adjudicated by a court of last resort, and of competent jurisdiction, to be invalid or illegal, the remainder of this Contract shall be unaffected by such adjudication, and all other provisions of this Contract shall remain in full force and effect as though the section, sentence, clause or phrase so adjudicated to be invalid had not been included herein.

SPECIAL REQUIREMENTS

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SPECIAL REQUIREMENTS FOR
THE CITY OF IMPERIAL
WASTEWATER TREATMENT PLANT UPGRADE PROJECT

1. THE REQUIREMENT

The work to be performed under this Contract consists of:

Contractor shall furnish all labor, material, equipment and services to perform and complete all work required for the **Wastewater Treatment Plant – Coarse Screen Installation** as per the Project Specifications. The project will generally include installation of a new screen structure with piping, gates, manholes, sewer pipe, and associated mechanical equipment; excavation of existing clarifier piping and modifications to the existing piping including plug valves and piping, installation of aluminum walkway on the existing Biolac divider wall, sewer by-pass during construction of screen structure, electrical modifications, general site work and electrical work; and all incidental work as required by the Specifications and Construction Drawings.

2. LOCATION OF CONTRACT WORK SITE

The Contract work site is in the City of Imperial in Imperial County, California located north of 14th Street and east of the Southern Pacific Railroad right-of-way within the city limits of Imperial, California. Refer to Sheet 1 of Contract Drawings for Vicinity Map.

3. EXAMINATION OF PLANS, SPECIFICATIONS, AND SITE OF WORK

The Bidder shall examine carefully, the site of the work contemplated. The submission of a bid shall be conclusive evidence that the bidder has investigated and is satisfied as to the conditions to be encountered as to the character, quality, and scope of work to be performed: the quantities of materials to be furnished, and as to the requirements of the bid proposals, plans, and specifications.

All existing elevations shown on the plans are approximate only. The Contractor shall recognize and acknowledge the condition that the bid lump sum price shall include all earthwork activities irrespective of the possible localized difference in contour elevations and actual ground; and that there will be no additional compensation from the Owner for earthwork changes, engineering, or field staking in this regard.

4. CONTRACT DRAWINGS

Sheet Nos. 1 through 26 (bound separately) accompany this specification and are made a part of the Contract Documents.

5. TIME OF COMPLETION AND LIQUIDATED DAMAGES

A. After the Contract Documents are executed, the City will give the Contractor notice to proceed. After this notice is given, all contract construction work shall be completed and the screening unit shall be field tested and operational within **210 (two-hundred and ten) calendar days**.

B. Due to the expected delivery lead time of the step screen; final project cleanup; completion of all final project "punch list" items; preparation and acceptance of O&M manuals; submittal of all as-built Record Drawings and Certifications; and completion of all miscellaneous contract requirements other than those specified above, shall be completed within **230 (two-hundred and thirty) calendar days.** Final acceptance testing shall not commence until the diesel generator has been installed and is operational.

Completion time in calendar days noted in Items A and B above includes Saturdays, Sundays, and holidays.

The liquidated damages of **$1,000.00 per calendar day** shall be deducted from any compensation due the Contractor should he fail to complete the work required by the terms of his Contract within the time specified in Item A above, plus any authorized time extensions. The amount of liquidated damages to be applied to Item B above shall be at the rate of **$300.00 per calendar day**.

Substantial completion is defined as the facility has been completely constructed, tested, field adjusted, started up, and operational in automatic mode.

6. CONSTRUCTION SCHEDULE

Contractor shall submit a construction schedule immediately after "Award of Contract". The schedule shall conform to the Contract Completion Schedule stated in these Special Requirements, and shall show dates for beginning and completing all aspects of contract work, including expected dates (both delivery and installation) for the required submittal data listed in these Special Requirements and the Detailed Specifications. Contractor shall understand that this schedule will be tentative, and subject to modification and updating by the Contractor (as approved by Owner) as the contract work progresses.

7. DATA TO BE SUBMITTED BY CONTRACTOR

Within ten (10) calendar days following Award of Contract, Contractor shall submit to Engineer for review and approval a complete submittal schedule, indicating all required submittals, expected submittals dates, and a submittal numbering system.

Within thirty (30) calendar days following Award of Contract, the Contractor shall submit to the Engineer for review and approval (before any material is purchased and/or before any shop fabrication is started), all required submittals per the Detailed

Technical Specifications; including detailed material and equipment lists and shop fabrication drawings for all items to be incorporated into the contract work. Contractor shall submit seven (7) copies of the submittals to the Owner's representative and shall be accompanied by a letter of transmittal listing the drawings submitted, the submittal number, and revision number of each submittal. Drawings shall show the name of the project, the name of the Contractor, and, if any, the names of suppliers, manufacturers, and subcontractors. Shop drawings shall be submitted with promptness and in an orderly sequence so as to cause no delay in prosecution of the work. A summary of the required submittals is listed below:

1. Screening and washing equipment, concrete and take-off of reinforcing bar requirements;

2. Shop Drawings for: fabricated piping, valves, fittings, pre-cast manhole, and all miscellaneous fabricated items.

3. Aluminum walkway and ancillary equipment;

4. Screening Equipment, including the automatic control system;

5. The Contractor shall submit, to the Owner for approval prior to beginning construction, a detailed plan relative to the proposed construction of the reinforced concrete screen structure. The plan shall include the location of all construction joints, keyways, and waterstops. The plan shall also include the sequencing and methods of construction, including excavation, forming, reinforcing placement, concrete pouring, and concrete finishing of vertical and sloping wall and sewer by-pass pumping. The Contractor is hereby notified that the reinforced concrete walls and floors shall be poured with interior and exterior forms. The Contractor shall not pour concrete against native earth.

Engineer will review each submittal (and subsequent re-submittal, if necessary) within fourteen (14) calendar days following date of receipt. Contractor shall be responsible for any delays in equipment delivery due to incompleteness of submittals and due to not meeting the submittal schedule outlined herein. Additionally, all costs associated with Engineering review beyond the second submission of any particular shop drawing or submittal shall be borne by the Contractor.

The Engineer’s approval of the contractor’s submittal shall not relieve the Contractor from having the entire responsibility for the correctness of details and dimensions. The Contractor shall assume all responsibility and risk for misfits due to any errors in the Contractor’s submittal data.

No portion of the work requiring a shop drawing submittal shall be commenced until the submittal has been reviewed by the Owner's representative and returned to the Contractor with a notation indicating that re-submittal is not required.

8. "OR EQUAL" ITEMS

In any case where these specifications call for one or more products, equipment, materials, or services by specific brand or trade name, which is then followed by the words "or approved equal" or similar, then the following procedures shall apply. A bidder wishing to substitute "an equal" item(s) shall specifically name or describe the proposed substituted item on the Certified Data Sheet. If the bidder has requested substitution of "an equal" item(s) on the Certified Data Sheet, the bidder shall submit data substantiating the request for a substitution of "an equal" item(s) with their bid proposal. Any changes or re-design required by the furnishing and installation of substituted material, equipment and other items shall be arranged for and paid for by the Contractor; and any expense so incurred shall be at no additional cost to the Owner. Additionally, no contract time extension will be granted for Owner or Engineer review time pertaining to a Contractor proposed equipment or material substitutions.

If the successful bidder has not requested in their bid the substitution of "an equal" item(s) or should the Engineer reject submitted items on the Certified Data Sheet and the Contractor fails to resubmit within seven (7) days, substitution will not be permitted. The Engineer shall have sole discretion to determine whether a proposed substitution is in fact "an equal" item.

9. CHANGE ORDERS

The following procedure supplements the Standard Specifications and must be followed in order for the Owner to approve payments for Change Orders:

First: The Contractor must report any condition for which he expects to claim an extra, to the Inspector and Owner immediately. A written claim shall be received by the Engineer within 10 days.

Second: Before any work on the Item to be claimed as an extra takes place, the Contractor must agree, in writing, to a lump sum price for doing the work.

Third: Upon the Owner's acceptance of the lump sum price, the Contractor must sign and return to the Owner, a formal Change Order Agreement.

Fourth: After the Change Order Agreement is signed by the Owner, the Contractor can proceed with the work on the Item claimed.

10. RIGHTS-OF-WAY

The contract work under these Special Requirements, Detailed Specifications, and Drawings for the City of Imperial Wastewater Treatment Plant Upgrade is located upon lands which are owned by the City of Imperial.

Contractor shall proceed with the contract work in such a manner, and as directed by the Owner, as to cause no permanent damage to land and/or trees and/or improvements outside of the site formation area.

11. PERMITS AND FEES

Contractor shall secure at his own expense all permits and/or licenses necessary to the prosecution of the contract work, except for any permits and/or licenses stated herein to have been secured and paid for by the Owner.

12. WORK TO BE DONE BY OTHERS

Work to be done by others is listed below:

a. SCADA programming

13. CONSTRUCTION WATER AND POWER

Owner will furnish non-potable construction water to the Contractor, free of charge, from existing water systems adjacent to a portion of the work. Contractor shall arrange with the City regarding placement of a hydrant meter; and shall furnish and install all necessary piping, fittings, connections, pumps, gages, etc., required to provide approved facilities to deliver construction water into pipelines to be constructed herein. Contractor shall fill all pipelines with construction water and may obtain construction water to be used in compacting trench backfill and for grading compaction. Contractor shall develop any other sources of construction water at his own expense.

The Contractor shall provide, at his own expense, all necessary power required for his operations under the Contract. The Contractor shall provide and maintain in good order such modern power equipment and installation as shall be adequate, in the opinion of the Owner to perform in a safe and satisfactory manner the work required by the Contract.

14. SEWAGE SPILL CONTAINMENT PLAN AND SEWER BYPASS / PHASING PLAN

Installation of the screen structure will require that a portion of the existing sewer flows to the Plant be contained and pumped to the existing aeration basins so that service is not interrupted. The Contractor shall generate, and submit to the City at the Pre-Construction Meeting, a "Sewage Spill Containment Plan and Sewer Bypass Phasing Plan" that details the general order of construction, complete with details of where, when, and how the Contractor plans to bypass the existing mainline flows. The temporary bypass will be allowed to operate overnight as required by construction. By-pass system shall be monitored at all times, even overnight.

The Contractor shall arrange for, furnish, and install all required bypass equipment, pumps, generators, screening equipment, piping, fittings, connections, etc. required to bypass the existing sewer flows during construction. All bypass equipment shall be installed and immediately operable to provide complete redundancy (primary and backup systems) to handle peak flow. Contractor shall provide for personnel to continuously monitor the bypass system and equipment.

Precise flow measurements have not been obtained; a rough approximation of flow for Existing MH #1 is 0.5 mgd and Existing MH #2 is 0.5 mgd. The bidder shall include all costs of bypassing the sewer in the appropriate bid item and no further compensation will be made to the Contractor by the City.

15. EXPORT MATERIAL

It is anticipated that some export material may be generated during site grading procedures and construction activities. Any material not suitable to complete the site grading in accordance with the contract drawings or excess generated material shall be placed on the jobsite as directed by the Owner. Excess material and/or unsuitable fill shall be placed and compacted to 80% R.C. minimum. All costs associated with importing or exporting material shall be included in the applicable bid prices and no additional compensation shall be made therefore.

16. DEWATERING AND EXCAVATION SHORING

It is anticipated that groundwater may be encountered at a depth of 10-15' below ground surface. Contractor shall assume all cost and liabilities incurred, should a groundwater problem arise. The Contractor shall be responsible for all dewatering activities, including water disposal, necessary to satisfactorily complete the project. The Contractor shall be responsible to provide all necessary trench and excavation shoring necessary to construct the facility in conformance with all applicable CAL-OSHA requirements. No additional payments will be made to the Contractor for dewatering efforts necessary to complete this project.

17. POTHOLING OF EXISTING UTILITIES BY CONTRACTOR

The Engineer has shown from a field check and/or record research the approximate location of known underground waterlines, electrical conduits, and gas line interference facilities. Other underground facilities, not shown on the Drawings, may and probably do exist. Therefore, it shall be the Contractor's responsibility to locate, protect, preserve, etc. all existing underground or overhead facilities in accordance with other applicable provisions of the Special Requirements, Detailed Specifications, and Drawings. In order to provide sufficient lead time to resolve unforeseen conflicts, order materials and take other appropriate measures to ensure that there is no delay in work, the Contractor shall expose all utility mains that must be crossed or closely paralleled at least five (5) working days in advance of commencing construction. The Owner reserves the right to make minor adjustments in alignment and grade, all at no additional cost to the Owner.

18. TRAFFIC AND ACCESS

Traffic and access shall comply with Section 7-10 of the "Standard Specifications for Public Works Construction" and "Work Area Traffic Control Handbook", (W.A.T.C.H.

Manual) as published by Building News, Inc. The Contractor's operations shall cause no unnecessary inconvenience. The access rights of the public shall be considered at all times. Unless otherwise authorized, traffic shall be permitted to pass through the work, or an approved detour shall be provided. At least one (1) lane on cross streets shall be available at all times for use of vehicles and emergency equipment. Safe and adequate pedestrian and vehicular access shall be provided and maintained to fire hydrants, commercial and industrial establishments of similar nature. Access to these facilities shall be continuous and unobstructed unless otherwise approved by the Engineer.

19. CONSTRUCTION STAKING

The Contractor shall provide construction staking required for the proposed work in accordance with the contract drawings.

The Contractor shall preserve bench marks, survey stakes, and points set for lines, grades, or measurement of the work in their proper places until authorized by the Owner to remove them. In case of their destruction or removal by him or his employees or agents, they shall be replaced at the Contractor's expense.

Cut sheets shall be furnished to the Inspector prior to any excavation or significant construction activity. The contractor shall employ a fully licensed and qualified surveyor to be approved by the Owner to provide the Construction staking for this project.

20. FIELD TEST, ADJUSTMENT AND INITIAL OPERATION

All mechanical and electrical equipment shall be tested by the Contractor to the satisfaction of the Owner and Engineer before any facility is put into initial operation. Tests shall be made to determine whether the equipment has been properly assembled, aligned, adjusted and connected. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the contract work. The following shall be part of the field testing and initial operation:

A. EQUIPMENT START-UP

After all acceptance tests have been completed by the Contractor and District but prior to final acceptance, the Contractor shall recheck all equipment for proper alignment and adjustment, check oil levels, re-lubricate all bearings and wearing points, and in general assure that all equipment is in proper condition for regular continuous operation.

B. OPERATION INSTRUCTIONS

The Contractor shall not install any item of machinery or process equipment until he has delivered to the engineer a copy of the manufacturer's installation instructions. Prior to final acceptance, the Contractor shall furnish to the engineer the number of bound sets of the Operations and Maintenance Manuals as described in the Special Conditions, for all such equipment.

C. AS-BUILT DRAWINGS

At the completion of all work, the Contractor shall furnish the engineer a set of as-built drawings. As-built drawings are prints of the contract drawings, marked to show all changes, additions, or modifications to the drawings brought about by the construction work.

D. PLANT FACILITIES

Before the facility goes on stream, if a 7-day test is not required, all channels, pipes, basins, reservoirs, and tanks shall be cleaned. Where practicable, cleaning shall be by washing down, otherwise broom cleaning will be acceptable.

21. OPERATING AND MAINTENANCE INSTRUCTIONS

Prior to final acceptance of the work, Contractor shall submit two (2) sets of the manufacturer's operating and maintenance instructions for each piece of equipment to the Engineer for approval. Operating and Maintenance Instructions shall be submitted for all mechanical, hydraulic, pneumatic, and electrical equipment involved in the project works and shall include replacement parts lists covering each piece of equipment or equipment assembly.

After approval of the preliminary submittals of operating and maintenance instructions by the Engineer, Contractor shall deliver five (5) complete sets of the Operating and Maintenance Instructions to the Engineer for distribution to the City. Each set of instructions shall be properly indexed and bound in a suitable cover.

22. CONTROLS WIRING AND SCADA CONNECTIONS

SKM Inc., shall be responsible to land all communication wiring between the proposed facilities and the existing WWTP PLC and establish SCADA communications between the proposed and existing facilities. The Contractor shall bring all signal wires and cables to the PLC as part of the contract work.

23. MISCELLANEOUS SPECIAL CONDITIONS

a. Pre-Construction Conference

The Contractor will be required to attend a pre-construction conference prior to beginning construction. The Owner will set up this conference shortly after execution of the contract. The attendees shall include the City of Imperial, Engineer, Contractor, Inspector, and all pertinent subcontractors.

b. Partial Payment Requests

Contractor shall submit all invoicing and requests for payment for completed portions of the work directly to the Owner for review and approval on an approved partial payment estimate form. Said invoicing shall be signed by the Inspector and submitted at intervals no less than 30 calendar days, generally by the 25th day of each month.

c. Compaction Testing

The Contractor will arrange for a qualified soils engineering laboratory to perform all compaction testing. The Contractor shall submit copies of all compaction tests to the Owner. Compaction test shall be performed in accordance with the soils report and as determined necessary by the soils engineer or record. Compaction testing will include, but is not limited to: all trenches (every 50 L.F.), building foundation (1 test per every 200 S.F. and below each building column footing), lift station slab, A.C. pavement, concrete foundations, and manhole subgrade.

d. Breakdown of Contract Price

Within 10 days following the date the Owner issues the written notice of "Award of Contract". Contractor shall submit a detailed price breakdown ("Schedule of Values") of any or all of this bid items for the work. Such price breakdown shall be in accordance with the bid items and sub-items indicated on the Certified Data Sheet; and shall include quantities, unit prices, and any other information required, in sufficient detail to enable it to be used by the Owner in preparing monthly payment estimates. The Breakdown of Contract Price" prepared by the Contractor shall be subject to approval by the Owner.

e. Concrete Testing Laboratory

The Contractor shall propose a concrete testing laboratory for employment, at their expense, to the Owner for review. If in the opinion of the Engineer the concrete testing laboratory is not able to meet the requirements of these specifications, the Contractor shall employ a laboratory recommended by the Owner. The cost of all concrete testing shall be the responsibility of the Contractor. The results of all concrete tests shall be submitted to the Owner immediately following testing. Concrete tests shall be made in accordance with Specification Section 3300.

f. Contractors Representative

The Contractor shall at all times, while work is being performed on this project, have a qualified superintendent who is a direct employee of the prime Contractor on-site who is responsible for the work being performed. The Contractor's representative shall be fully authorized to act on behalf of the Contractor.

24. STORM WATER POLLUTION PREVENTION PLAN (SWPPP)

The Contractor shall be responsible to prepare and submit the SWPPP for this project as required by the City. The Contractor shall also be solely responsible to ensure that all applicable provisions of the SWPPP are being adhered to continuously during the construction of the proposed facilities. All costs associated with the preparation and/or obtaining said SWPPP shall be borne by the Contractor.

PROJECT DESCRIPTION

Contractor shall furnish all labor, material, equipment and services and perform and complete all work required for the **Wastewater Treatment Plant – Coarse screen Installation**.

ALTERATIONS

The following alterations were made in this contract before it was signed by the parties hereto (if no alternates, state "NONE"): _

The Project must be completed as set forth in the Project Schedule. Bidder certifies that he/she can complete the Project, ignoring Delays and Changes as defined in the General Conditions as set forth in the Project Schedule.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of the date entered on the first page of the contract.

THE CITY OF IMPERIAL	CONTRACTOR
Signature _____	Signature _____
Title_____	Name_____
	Title
Attest:	EMPLOYER IDENTIFICATION NO. (As used on Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941)
_____ Debra Jackson City Clerk	

DETAILED SPECIFICATIONS

THE CITY OF IMPERIAL
STATE OF CALIFORNIA

Wastewater Treatment Plant – Coarse Screen Installation

DIVISION 1

GENERAL

DIVISION 1
TABLE OF CONTENTS

SECTION 01340
SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 SUMMARY

This Section includes the preparation and submission of shop drawings, product data, and samples as specified herein and in the various sections of these specifications. The requirements specified herein are in addition to requirements for shop drawings, product data, samples, materials lists, substitutions of materials, or other submittals specified elsewhere in these specifications. The Conditions of the Contract and the other sections of Division 1 apply to this section as fully as if repeated herein. (Refer to "Special Provisions").

1.02 GENERAL SUBMITTAL PROCEDURES

A. SCHEDULING: Extension of Contract time will not be granted because of the Contractor's failure to make timely submittals. Do not purchase materials or equipment or begin construction activities covered by the required submittals until submittals have been reviewed, approved, and returned.

B. TRANSMITTAL: Accompany each submittal with a dated, signed and sequence numbered transmittal on forms prescribed by the City. Include information required by this form including project identification, name and address of Contractor and of subcontractor or supplier, a list of items included in the submittal, and identification of drawing numbers, specification section and paragraph numbers to which the submittal pertains, and space for Contractor's and Engineer's review and approval stamp.

C. SETS AND COPIES: Provide for approval a minimum of seven (7) sets of each required submittal.

1.03 SHOP DRAWINGS AND PRODUCT DATA

A. SHOP DRAWINGS: The term "shop drawings" as used herein includes fabrication and installation, layout and setting drawings; wiring and control diagrams; and other drawings.

1. Check and verify all field measurements and submit for review, with such promptness as to cause no delay in the Work or in that of any other contractor or subcontractor, all shop or setting drawings and schedules required for the construction activities of the various trades.
2. Drawings shall show all information required by the applicable technical section and shall be in sufficient detail as may be required

to show that fabricated materials, equipment or systems, and the positions thereof conform to the Contract Documents.

3. Shop drawings shall establish the actual detail of fabricated items, indicate proper relation of adjoining construction, amplify design details of mechanical and electrical equipment in proper relation to physical spaces in the structure, and incorporate minor changes of design or construction to suit actual conditions. Shop drawings shall be drawn to scale and shall be completely dimensioned.
4. Prepare shop drawings on sheet of same size as contract drawings or on 8-1/2" x 11" three-hole punched vellum-type sheets suitable for both xerox and ozalid reproduction.
5. Each shop drawing shall have a title block containing the following information:
   (a) Name and location of the Project.
   (b) Name and address of the Contractor.
   (c) Name and address of the subcontractor, manufacturer, supplier or distributor as applicable.
   (d) Name and address of City.
   (e) Date, scale of drawings and identification number.
   (f) Space for the Contractor's review and approval stamp.
6. Submit seven (7) blue or black line prints and one reproducible transparency of each shop drawing.

B. PRODUCT DATA: The term "product data" as used herein includes manufacturer's standard drawings, certificates of conformance, substantiating calculations and other data.
1. The data shall include all information required by the applicable technical section and shall be in sufficient detail to show that manufactured materials and equipment conform to the Contract Documents.
2. Catalog Cuts: Clearly mark each copy to indicate the product or model as well as optional sizes, finishes or other features proposed for use. Delete inapplicable data.

1.04 SAMPLE

Furnish for review samples of the various materials, together with the finish thereon, as specified for and intended to be used on or in the Work. Submit samples to the Engineer for review before purchasing, fabricating, applying, or installing such materials and finishes.

Submit samples, other than field samples, in duplicate. A cover letter shall accompany the sample and shall list all items being transmitted, designating their particular usage and

location in the Work and shall be identified as to manufacturer, trade name, style, model. One approved sample will be returned to the Contractor.

Approval of a sample shall not be taken in itself to change or modify any contract requirement. Materials, finishes, and workmanship in the completed building shall be equal in every respect to that of the approved sample.

1.05 ENGINEER'S ACTION

A. The Engineer will review the submittals with reasonable promptness, fourteen (14) calendar days maximum, and will affix the Engineer's initials or signature as follows:
   1. Submittals stamped "NO EXCEPTION TAKEN" require no further action, and fabrication or construction may proceed. The Engineer will forward to the Contractor two (2) stamped copies of shop drawings, brochures, schedules, materials lists, and other product data, except where required otherwise for the Engineer's review, approval and distribution to the Contractor.
   2. Submittals stamped "MAKE CORRECTIONS NOTED" or "APPROVED AS NOTED" require no further action, and fabrication or construction may proceed contingent upon all corrections being made as noted. Quantities returned will be as specified in paragraph 1.05.A.1.
   3. Submittals stamped "REJECTED" or "REVISE AND RESUBMIT" require the Contractor to resubmit them with reasonable promptness, and no fabrication or construction may begin. The Engineer will return to the Contractor two (2) marked copies of shop drawings, brochures, schedules, materials lists, and other product data (all stamped).

B. RESUBMITTALS: If first or subsequent submittal is stamped "REJECTED" or "REVISE AND RESUBMIT", corrective action shall be taken and resubmittal procedure shall be the same as for first submittal. Upon resubmitting, the Contractor shall direct specific attention in writing to revisions other than those corrections requested by the Engineer on the returned, original submittal or shop drawings.

C. The Engineer will check and take action on such drawings and schedules only for conformance with the design concept of the Work and compliance with information given in the Contract Documents. When so directed by the Engineer or the City, the Contractor shall make corrections required.

D. The Engineer's and City's review of shop drawings will be general only and shall not relieve the Contractor from responsibility for errors of any sort, for deviations from Drawings or Specifications, or for conflict with the construction activities of others that may result from such deviations.

Engineer's and City's review of a separate item does not indicate a review of an assembly in which the item functions.

1.06 CONTRACTOR'S ACTION

A. DISTRIBUTION COPIES: The Contractor shall be responsible for obtaining required prints and for distribution to subcontractors. Distribution copies shall be made from the transparency bearing the Engineer's stamp.

B. The Contractor shall check the drawings of his suppliers and subcontractors as well as his own drawings before submitting them. In particular, the Contractor shall ascertain that the drawings meet all requirements of the Contract Drawings and Specifications and conform to the structural and space conditions. If such shop drawings show variations from Contract Documents, whether because of standard shop practice or other reasons, the Contractor shall clearly describe such variations including other changes required to correlate the construction in his letter of transmittal.

C. Each submittal by the Contractor shall have the following Certification Statement, signed by the Contractor:

"Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable submittals and other requirements of the contract documents."

D. Submittals shall be complete in all respects. If the submittals show any deviations from the requirements of the contract documents because of standard shop practices or other reasons, the deviations and the reasons therefor shall be set forth in the letter of transmittal.

E. By submitting the submittals, the Contractor represents that the material, equipment, and other work shown thereon conforms to the contract documents, except for the deviations set forth in the letter of transmittal.

END OF SECTION 01340

SECTION 01510
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION
This Section includes the requirements for temporary facilities for the project work. Contractor shall provide the temporary facilities for the entire duration of the project work at no additional cost to the City.

1.02 FIRST AID AND PROTECTIVE FACILITIES
First aid facilities and supplies shall be kept on the jobsite. Instructions in first aid shall be given, and Contractor shall provide emergency first aid treatment and supplies for his employees sufficient to comply with all legal requirements.

1.03 FACILITIES FOR EMPLOYEES
Contractor shall, at his own expense, provide all labor, materials, equipment, and facilities which may be required to carry out effectively the provisions of these specifications.

1.04 POWER
Provide all necessary power required for operations under the contract. The Contractor shall provide and maintain in good order such modern power equipment and installation as shall be adequate, in the opinion of the City, to perform in a safe and satisfactory manner the work required by the Contract.

1.05 SANITATION
All parts of the work shall be maintained in a neat, clean, sanitary condition. Fixed and portable toilets, which are made inaccessible to flies, shall be provided wherever needed for use of employees, and their use shall be strictly enforced. All waste and refuse from sanitary facilities provided by the Contractor or from any source related to Contractor's operations shall be disposed of in a sanitary manner, satisfactory to the City, and in accordance with the laws and regulations pertaining thereto. Contractor shall rigorously prohibit and prevent committing of nuisance within the work site area or upon the City's right-of-way or adjacent to private property. Contractor shall furnish all facilities and means for proper sanitation of the work, and shall protect and safe harmless the City, its officers and employees from any liability resulting from improper or insufficient sanitation.

1.06 PROJECT CLEANUP

A. CLEANUP REQUIREMENTS:
   1. Maintain project site(s) in a neat and clean condition at all times.
   2. Abate dust nuisance by cleaning, sweeping and sprinkling with water; and other means as necessary.

3. Prevent spillage on haul routes.
4. Immediately remove excess excavated material from pipe trench except for sufficient backfill material.
5. Remove forms and lumber from site immediately after stripping.
6. Do not discharge smoke, dust or other air contaminants into the atmosphere in such quantity as will violate the regulations of any legally constituted authority.

B. COMPLIANCE: Failure of the Contractor to comply with the City's cleanup orders may result in an order to suspend work until the condition is corrected. No additional compensation will be allowed as a result of such suspension.

C. FINAL CLEANUP: Upon completion of work and before the final estimate is submitted, the Contractor shall, at his own expense and cost, satisfactorily dispose of or remove from the vicinity of the work all plants, buildings, rubbish, unused materials, concrete forms, and other equipment and materials belonging to him or used under his direction during the construction, and in the event of his failure to do so, the same may be removed and disposed of by the City at the Contractor's expense.

1.07 TRAFFIC CONTROL

A. CONTROL EQUIPMENT AND DEVICES: Provide traffic warning signs, barricades, flagmen, and other control devices as required to maintain two-way traffic, over roadways in project work area.

B. AGENCY REQUIREMENTS: Investigate and adhere to traffic control and equipment of various agencies having jurisdiction over the right-of-way in the work area.

C. COMPLIANCE: Costs for compliance with all traffic control provisions shall be considered as included in the bid unit price for various items, and no other compensation shall be made therefor.

1.08 ACCESS TO ADJACENT PROPERTIES

A. PROPERTY ACCESS REQUIREMENTS:
1. Provide access to the properties in the work area at all times during construction.
2. Notify City in advance of any necessary closure to adjacent property and provide 24 hours notice to that affected properties.
3. Provide temporary structures as required for reasonable access to the adjacent properties.
4. At least one (1) lane on cross streets shall be available at all times for use of vehicles and emergency equipment.

B. COMPLIANCE: Costs for compliance with all traffic control provisions shall be considered as included in the bid unit price for various items, and no other compensation shall be made therefor.

END OF SECTION 01510

SECTION 01530
PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 GENERAL:

A. The Contractor shall protect all existing utilities, piping and improvements not designated for removal and shall restore damaged or temporarily relocated utilities, piping and improvements to a condition equal to or better than they were prior to such damage or temporary relocation.

B. The Contractor shall verify the exact locations and depths of all underground piping and utilities shown and not shown and shall make exploratory excavations of all piping and utilities that may interfere with the Work. It shall be the Contractor's responsibility to ascertain the actual location of all existing utilities, piping and other improvements that will be encountered in its construction operations and to see that such utilities or other improvements are adequately protected from damage due to such operations.

C. Maintaining in Service: All pipelines, electrical, power, telephone, communication cables, gas and water mains shall remain continuously in service during all the operations under the Contract, unless other arrangements satisfactory to the Engineer are made with the Owner. Where the proper completion of the Work requires the temporary or permanent removal and/or relocation of an existing utility or other improvement the Contractor, after necessary scheduling and approval, shall remove and, without unnecessary delay, temporarily replace or relocate such utility or improvement in a manner satisfactory to the Engineer and the owner of the facility. In all cases of such temporary removal or relocation, the Work shall be accomplished by the Contractor in a manner that will restore or replace the utility or improvement to a new condition meeting the specification requirements.

D. All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the improvement owner before being concealed by backfill or other work.

1.02 RIGHTS-OF-WAY:

A. The Contractor shall not do any work or enter upon the rights-of-way of any oil, gas, sewer or water pipeline; any telephone or electric transmission line; any fence; or any other structure, until notified by the Engineer that the Owner has secured authority to do so. After authority

has been obtained, the Contractor shall give the governing utility proper advanced notice of its intention to begin work.

1.03 RESTORATION OF PAVEMENT AND SIDEWALKS:

A. All paved areas and sidewalks not designated for replacement, cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas unless otherwise noted. All sidewalks and pavements which are subject to partial removal shall be neatly saw cut in straight lines.

1.04 UNDERGROUND UTILITIES NOT SHOWN OR INDICATED:

A. If the Contractor damages existing utilities, piping or improvements that are not shown or the location of which was not made known to the Contractor prior to excavation and the damage was not due to failure of the Contractor to exercise reasonable care the Contractor shall immediately notify the Engineer. If directed by the Engineer repairs shall be made by the Contractor under the provisions for changes and extra work contained in Articles 13, 14, and 15 of the General Conditions.

1.05 NOTIFICATION BY THE CONTRACTOR:

A. Prior to any excavation in the vicinity of any existing underground facilities, including water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications or telecommunication cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way, the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three (3) working days prior to excavation so that a representative can be present during such work if they are required to do so.

END OF SECTION 01530

SECTION 01700
PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 DESCRIPTION

This section details requirements and provisions to be performed by the Contractor and for the City prior to final acceptance of the project and closing out the Contract. The requirements specified in the Conditions of the Contract, Special Provisions, and the Detailed Technical Specifications apply to this section as fully as if repeated herein.

1.02 FIELD TESTING AND OPERATIONAL DEMONSTRATION

A. PROCEDURES: Submit schedule and complete procedures and informational data to Engineer for review and approval in accordance with Special Provisions and Section 15064.

B. FIELD TESTING: Conduct field start-up, testing and operational demonstration in accordance with Special Provisions and Section 15064.

C. SUBMITTALS: Provide all final submittals to Engineer for review and approval in accordance with all applicable sections of Divisions 15 and 16.

1.03 REQUIREMENT PREPATORY TO FINAL INSPECTION

A. TEMPORARY FACILITIES: Remove all temporary facilities from site.

B. CLEANING: Clean the entire project site(s) of all debris, Contractor materials, etc. as approved by Inspector. The pump building shall also be thoroughly cleaned prior to the Final Inspection.

C. PUNCH LIST: Complete all preliminary punch list items as approved by Inspector.

D. TESTING: Complete all field testing requirements per the Specifications.

E. RECORD DRAWINGS: Submit record (as-built) drawings to City. Drawings shall be complete and signed by the Contractor.

F. OPERATING AND MAINTENANCE MANUAL: Submit preliminary copies to Engineer for review and approval in accordance with the Special Requirements. Final, approved submittals will be required in advance of the filing of the "Notice of Completion."

G. TOOLS, KEYS AND MISCELLANEOUS EQUIPMENT: Deliver all tools which are a permanent part of the equipment installation in the work

to the City. Also deliver touch-up paint, spare parts, all keys (properly identified), etc.

H. PERMITS: Obtain final approvals from all agencies issuing permits and/or having involvement in the project such as Fire Department, Flood Control District, various City Departments, etc.

I. FINAL QUANTITIES: See Paragraph 1.06 herein.

1.04 SPECIAL SYSTEM OPERATING AND MAINTENANCE INSTRUCTIONS

A. OPERATING INSTRUCTIONS: Separate from the required Operating and Maintenance Manual, submit typewritten instructions covering operation of the entire system as installed (not duplicating manufacturer's instruction for operating components). Include schematic flow and control diagrams as appropriate and show and list system valves, control elements, and equipment components using identification symbols and numbers. Show proper settings for valves, controls and switches.

B. MAINTENANCE INSTRUCTIONS: Separate from the Operating and Maintenance Manual, and not duplicating manufacturer's detailed instructions, submit typewritten instructions covering routine maintenance of the system. List each item of equipment requiring inspection, lubrication, or service and briefly describe such maintenance, including types of lubricants and frequency of service. Give name, address and phone number of nearest firm authorized and/or qualified to service equipment or provide parts.

C. WALL MOUNTED DATA: Frame one set of the approved typewritten instructions and diagrams described under paragraph 1.04 A and 1.04 B above, covered with glass and mounted in locations as directed by City.

1.05 MANUFACTURERS' WARRANTIES

Deliver all manufacturers' warranties required by the Contract Documents, with City named as the beneficiary. In addition, for all equipment and machinery, or components thereof, bearing a manufacturers' warranty that extends for a longer time period than the Contractor's warranty, secure and deliver the manufacturers' warranties in the same manner.

Written warranties, except manufacturers' standard printed warranties, shall be on the Contractor's, subcontractor's, material suppliers', or manufacturer's own letterhead, or a form approved by City. Submit all warranties in duplicate. All warranties shall be collected and assembled into a bound booklet form, and delivered to the City for final review and approval.

1.06 FINAL QUANTITIES AND PAY ESTIMATE

The Contractor's superintendent shall coordinate with the project inspector, prior to the final inspection, for purposes of reviewing and resolving all final as-built quantities for payment purposes. Once the tabulation of final quantities is completed and approved by the Inspector, the final pay estimate may be submitted. Final quantities are subject to approval of the City. Payment of retention will not be approved until after final inspection and acceptance of project. Refer to General Provisions for additional information.

1.07 FINAL INSPECTION

If the Work has been completed in accordance with the Contract Documents, and no further corrective measures are required, the City will accept the Work, finalize the payment processing, obtain the "Release" from the Contractor, and file for the Notice of Completion.

If the Work has not been completed in accordance with the Contract Documents, and several corrective measures are still required, the City will not accept the Work or file for the Notice of Completion. Instead, a final punch list shall be prepared by the City, based on the information gathered from the final inspection. The Contractor will be required to complete or correct the items listed on this punch list to the satisfaction of the Inspector, and then call for another final inspection, following the procedure outlined above.

Upon acceptance of the Work by the City, Contractor shall submit his request for acceptance and final payment. Final payment will not be made by the City, however, until 35 days after filing for the Notice of Completion.

END OF SECTION 01700

SECTION 01820
FIELD TESTING AND OPERATIONAL DEMONSTRATIONS

1.01 GENERAL

Upon completion of work and prior to acceptance by City, Contractor shall provide field testing, demonstrations, validations, etc. for the well pump facilities as described herein.

1.02 MANUFACTURERS' SUPERVISION AND INSTALLATION CHECK

Each equipment manufacturer shall furnish the services of an authorized representative especially trained and experienced in the installation of his equipment to (1) supervise the equipment installation in accordance with the reviewed Instruction Manual, (2) be present when the equipment is first put into operation, (3) inspect, check, adjust as necessary, and approve the installation, (4) repeat the inspection, checking, and adjusting until all trouble or defects are corrected and the equipment installation and operation are acceptable, (5) witness and supervise operational demonstrations and system validation tests to the extent specified, and (6) prepare and submit the specified Manufacturers' Certified Report (Appendix). Include all costs for representatives service in the Contract Price.

1.03 SUBMITTALS FOR OPERATIONAL DEMONSTRATION AND SYSTEM VALIDATION TESTS

1. Operational Demonstration: When the Contractor's application for a progress payment equals or exceeds 75% of the Contract value for the first time, submit a detailed and comprehensive procedure plan for performance of each operational demonstration required. Identical equipment items may be covered under one plan. Include an estimated date and duration for each procedure and the personnel required.
2. System Validation Tests: When the Contractor's application for a progress payment equals or exceeds 75% of the Contract value for the first time, submit a detailed and comprehensive procedure plan for performance of each separate validation test and for each validation test that covers two or more systems. Each procedure plan shall describe and itemize the involved system, including associated electrical equipment and instrumentation and control systems, and shall include evidence of an organized step-by-step procedure properly coordinating the efforts of the various trades and manufacturers' representatives involved and of the operations of the facilities. Procedures shall include an estimated duration and date for each procedure and the personnel required.
3. Procedure Plan Information: In addition to the information specified above, each procedure plan shall include the following information as applicable:

a. Description of temporary procedure facilities, including Drawings and sketches as required to fully illustrate the facilities.
b. List of test materials and estimated quantities.
c. List of instruments, measuring and recording devices, and other test equipment, whether a part of the plant or furnished separately for temporary use.
d. Names of supervising and inspecting manufacturers.
e. Complete listing of all functional parameters to be observed and recorded.
f. Recording intervals.

4. Records Materials: Submit samples of the forms, charts, and other materials to be used in recording demonstration and validation test results.
5. Results: Within 10 days after completion of each procedure plan submit 3 copies of all recordings and results of all operational demonstrations and system validation tests.

1.04 FIELD QUALITY CONTROL

A. GENERAL: All costs for performing operational demonstrations and system validation tests shall be included in the Contract Price, and no extra payment will be made to the Contractor due to overtime, weekend, or holiday labor costs required to perform and complete the demonstrations and validation tests. Requirements specified in this Article are in addition to the demonstration and test requirements specified under other Sections of these Specifications.

1. Operational Demonstration and Systems Validation Testing shall be performed by the Contractor in accordance with the approved procedure plans to demonstrate to City's satisfaction that:
   a. All components of the process systems defined herein, the complete systems, and the new plant systems are fully completed and operable.
   b. All units, components, system, and the entire plant systems operate with the efficiency, repeatability, and accuracy indicated and specified.
   c. All components, systems and the entire plant conform to the Contract Documents and the reviewed shop drawings, samples, construction manuals, materials lists, and other reviewed submittals.
2. Scope of Demonstrations and Validation Testing: Operational demonstrations and system validation tests are required for all Work, equipment, and systems specified in these Specifications including all associated and related electrical systems and control devices.

a. Equipment and work to be operationally demonstrated are defined as individual equipment items such as pumps, compressors, mixers, sludge collecting mechanisms, belt press and like equipment items. Demonstrations shall be performed simultaneously on groups of identical equipment items and groups of items supplied by one manufacturer to the extent feasible.

b. Systems to be validation tested are defined as complete systems that perform a discrete process function of the plant such as chemical systems, pumping system, screen and conveyor system, sluice gates, and similar systems. Each system shall include associated structures, tanks, piping, utilities, instrumentation and controls, and like related items. Two or more separate systems shall be validation tested simultaneously when necessary to validate an entire discrete plant function.

3. Prerequisite Conditions: Operational demonstrations and validation testing shall not commence for any equipment item or system until all related structures, piping, electrical, instrumentation, control, and like Work has been installed, tested, and connected in compliance with the pertaining requirements specified elsewhere in the Specifications.

4. Demonstration and Testing Materials: Furnish materials, natural gas and/or electrical power for operational demonstrations and validation tests. Use fresh water to fill tanks, wells, piping, and systems that contain water in normal operation. Use the specified chemicals for chemical systems but do not exceed "in service" concentrations. Furnish temporary facilities as required such as by-pass or re-circulation piping, diversions, storage, and similar facilities. Use procedures that conserve testing materials and avoid wastage, especially with respect to large quantities of fresh water and electrical power.

5. Inspection and Supervision by Manufacturers: perform operational demonstrations and system validation testing under continuous inspection by City. Technical representatives of the various equipment manufacturers shall be present at the start of the operational demonstrations, shall examine their equipment at least twice near the beginning and end of the validation tests, shall supervise the start up and adjustment procedures, and shall perform all other services necessary for the manufacturer's certified reports required herein.

6. Correction of Defects: Immediately correct all defects and malfunctions disclosed by demonstrations and validation tests using approved methods and new materials for repairs as required.

Interruption time necessary for corrective work shall be added to the specified total demonstration and validation test periods.

7. Acceptance: Satisfactory completion and approval of required operational demonstrations and system validation testing is one of the conditions precedent to City's acceptance of the Work and does not constitute final acceptance. Refer to the Conditions of the Contract.

B. OPERATIONAL DEMONSTRATIONS: Demonstrate that the performance of installed equipment complies with all requirements indicated and specified. Operate each equipment items through entire no-load to full-load range in accordance with the approved procedure plan for not less than 24 consecutive hours, unless a longer period is specified under other Sections.

C. SYSTEM VALIDATION TESTS: All equipment components of each system shall have successfully completed the required operational demonstration before the system is validation tested. Perform validation testing in accordance with the approved procedure plan.

1. Test Period: Test each system, including standby systems, by continuous operation in "in-service" condition for not less than 48 consecutive hours, with no interruptions except for normal maintenance of corrective Work.
2. Testing Methods: Operate systems continuously 24 hours a day under constant inspection of trained operators. Cycle system operation from full load to light load and back to full load each 24 hours; cause variable speed equipment to cycle through the applicable speed range at a steady rate of change. Induce simulated alarm and distressed operating conditions, and test controls and protective devices for correct operation in adjusting system functions or causing system shutdown.
3. Simulation of Conditions: Subject to Contractor's request and City’s review in each case, the Contractor may simulate certain operating conditions relating to flow rates, water levels, and malfunctions. Permission for simulations will be granted only where it is unwise or impossible to obtain the conditions covered by the capability of ranges or equipment. The simulation methods shall reflect reasonable anticipated operating conditions.
4. Ranges for Testing:
    a. Flow metering Systems shall be tested at not less than 3 values corresponding approximately to a minimum, average and maximum capacity, respectively.
    b. Liquid Level Indicating Systems shall be tested at not less than 5 levels corresponding approximately to low, average, normal, maximum and high alarm levels, respectively. Low-

low and high-high level alarms and system reaction shall also be tested where equipment or instruments are required to react to such conditions.

c. Remotely Controlled Valves shall demonstrate suitable operation both from local controls and remote controls. As a minimum, these procedures shall include full-open and full-close positioning. Each test shall be repeated not less than 3 times for non-throttling and non-modulating valves. In addition to these minimum requirements, and subject to approval, all throttling valves and modulating valves shall be operated at not less than 3 intermediate positions and shall demonstrate the ability of each valve to hold the set position under operating conditions.

d. Variable Speed Equipment shall demonstrate accurate response to speed controlling devices and controls within the required operating ranges. Actual output shaft speeds of manually adjustable speed equipment shall be validated by measurement of shaft speeds versus speeds shown by equipment instruments.

5. Automatic Response of Equipment: Response of equipment to appropriate manual or automatic controls, or combinations of both automatic and manual controls, shall be demonstrated to be correct and accurate. Where applicable, all components shall be tested for both manual and automatic operation. Where a component performs more than one function, every function shall be validated.

a. Pumping Equipment shall respond accurately and reliably to liquid level and flow rate signals from appurtenant reservoirs, or wet wells. Automatic alternation and back-up pump functions shall also be validated.

b. Auxiliary Equipment Items such as automatic samplers, annunciators, alarms, and like items shall respond accurately and reliably to every condition for which they are programmed, in the manner specified.

D. RECORDING OF DATA: Neat and comprehensive records of each operational demonstration and system validation test shall be maintained by the Contractor. Each portion of the demonstration or validation procedure shall be described with all components itemized. Records shall be prepared on forms in a step-by-step fashion paralleling the approved plans. Forms shall list for each condition:

a. Step taken;
b. Result anticipated;
c. Result obtained
d. If incorrect, corrective action taken; and
e. Retest result.

f. Steps (d) and (e) shall be repeated until all systems operate as required.

1. Recording Devices: Instruments, gages, and other sensor and display devices forming a part of the various systems shall be employed for data acquisition to the extent applicable. The Contractor shall furnish all other instruments, gages, recorders, and test devices as required, types conforming to the approved procedure plans.
2. Information and Intervals: All applicable data such as, but not limited to, water and other liquid levels, flows, pressures, head differentials, duration of runs, instrument readings, chemical feed rates, voltage settings, drive speeds, motor running currents, torque, voltage, gpm, pressures, clarity, residual chlorine and related information, as applicable, and in accordance with the approved procedure plans, shall be recorded at the start and finish of every operational demonstration and at maximum 8-hour intervals during system validation tests, unless shorter intervals are specified elsewhere.
3. Repetitions: When a repeat of the same demonstration or validation test is required to verify the results, the repeat procedure shall be indicated on the recorded data by numerical indication, date, and time.

1.05 CONSOLIDATION OF DEMONSTRATION, TESTING, AND INSTRUCTION REQUIREMENTS

Operational demonstrations, system validation testing, and instruction of the City's personnel may be performed simultaneously, subject to prior approval of the extent of consolidation in each case.

END OF SECTION 01820

DIVISION 2

SITE WORK

DIVISION 2
TABLE OF CONTENTS

SECTION 02050
DEMOLITION

PART 1 - GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this Section:

1. American National Standards Institute (ANSI): A10.6, Safety Requirements for Demolition Operations.

2. Occupational Safety and Health Administration (OSHA), U.S. Code of Federal Regulations (CFR) Title 29 Part 1926 Occupational Safety and health Regulations for Construction.

3. Environmental Protection Agency (EPA), U.S. Code of Federal Regulations (CFR), Title 40:

a. Part 61 National Emission Standards for Hazardous Air Pollutants.
b. Part 82 Protection of Stratospheric Ozone.
c. Part 273 Standards for Universal Waste Management.

1.02 DEFINITIONS

A. ACM: Asbestos-containing material.

B. DEMOLITION: Dismantling, razing, destroying, or wrecking of any fixed building or structure or any part thereof and the debris shall be removed from the jobsite.

C. SALVAGE/SALVAGEABLE: Remove and deliver, to the specified location(s), the equipment, building materials, or other items so identified to be saved from destruction, damage, or waste; such property to remain that of Owner. Unless otherwise specified, title to items identified for demolition shall revert to Contractor.

D. UNIVERSAL WASTE LAMP: In accordance with 40 CFR 273, the bulb or tube portion of an electric lighting device, examples of which include, but are not limited to, fluorescent, high-intensity discharge, neon, mercury vapor, high-pressure sodium, and metal halide lamps.

E. UNIVERSAL WASTE THERMOSTAT: A temperature control device that contains metallic mercury in an ampule attached to a bimetal sensing

element, and mercury-containing ampules that have been removed from these temperature control devices in compliance with the requirements of 40 CFR 273.

1.03 SUBMITTALS

A. INFORMATIONAL SUBMITTALS:

1. Submit proposed Demolition/Renovation Plan, in accordance with requirements specified herein, for approval before such Work is started.
2. Submit copies of any notifications, authorizations and permits required to perform the Work.
3. Submit a shipping receipt or bill of lading for all containers of ACM shipped.
4. Submit a shipping receipt or bill of lading for all universal waste shipped.

1.04 REGULATORY AND SAFETY REQUIREMENTS

A. When applicable, demolition Work shall be accomplished in strict accordance with 29 CFR 1926-Subpart T.

B. Comply with federal, state, and local hauling and disposal regulations. In addition to the requirements of the General conditions, contractor's safety requirements shall conform to ANSI A10.6.

C. Furnish timely notification of this demolition project to applicable federal, state, regional, and local authorities in accordance with 40 CFR 61-subpart M.

1.05 DEMOLITION/RENOVATION PLAN

A. Demolition/Renovation Plan shall provide for safe conduct of the Work and shall include:

1. Detailed description of methods and equipment to be used for each operation;
2. The contractor's planned sequence of operations, including coordination with other work in progress;
3. Procedures for removal and disposition of materials specified to be salvaged.

1.06 SEQUENCING AND SCHEDULING

A. The Work of this Specification shall not commence until contractor's Demolition/Renovation Plan has been approved by Engineer.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 EXISTING FACILITIES TO BE DEMOLISHED OR RENOVATED

A. FACILITIES:

1. Portions of buildings and other areas scheduled for selective demolition, partial demolition, and renovation Work are as shown in the drawings.

B. UTILITIES AND RELATED EQUIPMENT:

1. Notify Owner or appropriate utilities to turn off affected services at least 48 hours before starting demolition activities.
2. Remove existing utilities as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by Engineer.
3. When utility lines are encountered that are not indicated on the Drawings, notify owner prior to further work in that area.
4. Remove meters and related equipment and deliver to a location as determined by the Owner.

3.02 PROTECTION

A. Contractor shall coordinate all demolition activities with the Owner and their designated representative. The remaining facilities at each shall remain in service during demolition. Removal and plug of waterlines and drain lines shall be conducted during times of minimal impact to the operations at each site and with the approval of the Owner.

B. DUST AND DEBRIS CONTROL:

1. Prevent the spread of dust and debris to occupied portions of the building and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

2. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to vehicular traffic.

C. TRAFFIC CONTROL SIGNS: Where pedestrian and driver safety is endangered in the area of removal work, use traffic barricades with flashing lights.

D. EXISTING WORK:

1. Survey the site and examine the Drawings and Specifications to determine the extent of the work before beginning any demolition or renovation.
2. Take necessary precautions to avoid damage to existing items scheduled to remain in place, to be reused, or to remain the property of Owner; any Contractor-damaged items shall be repaired or replaced as directed by Engineer.
3. Provide temporary weather protection during interval between removal of existing exterior surfaces and installation of new to ensure that no water leakage or damage occurs to structure or interior areas of existing building.
4. Ensure that structural elements are not overloaded as a result of or during performance of the work. Responsibility for additional structural elements, or increasing the strength of existing structural elements as may be required as a result of any work performed under this Contract shall be that of the Contractor. Repairs, reinforcement, or structural replacement must have engineer approval.
5. Do not overload pavements to remain.

E. WEATHER PROTECTION: For portions of the building scheduled to remain, protect building interior and materials and equipment from weather at all times. Where removal of existing roofing is necessary to accomplish the work, have materials and workmen ready to provide adequate and temporary covering of exposed areas so as to ensure effectiveness and to prevent loss.

F. TREES: Protect trees within site which might be damaged during demolition or are indicated to be left in place, by a 6-foot high fence. The fence shall be securely erected a minimum of 5 feet from the trunk of individual trees or follow the outer perimeter of branches or clumps of trees. Any tree designated to remain that is damaged during the work shall be replaced in kind, as approved by Engineer.

G. FACILITIES:

1. Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities.
2. Floors, roofs, walls, columns, pilasters, and other structural elements that are designed and constructed to stand without lateral support or shoring, and are determined by Contractor to be in stable condition shall remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Engineer.
3. Protect all facility elements not scheduled for demolition.
4. Provide interior shoring, bracing, or support to prevent movement, settlement, or collapse of structure or element to be demolished and adjacent facilities.

H. PROTECTION OF PERSONNEL:

1. During demolition, continuously evaluate the condition of the structure being demolished and take immediate action to protect all personnel working in and around the demolition site.
2. Provide temporary barricades and other forms of protection to protect Owner's personnel and the general public from injury due to demolition work.
3. Provide protective measures as required to provide free and safe passage of Owner's personnel and the general public to occupied portions of the structure.

3.03 BURNING

A. The use of burning at the site for the disposal of refuse and debris will not be permitted. Where burning is permitted, adhere strictly to federal, state, and local regulations.

3.04 BACKFILL

A. Do not use demolition debris as backfill material.

B. Fill excavations, open basements and other hazardous openings to existing ground level or foundation level of new construction in accordance with Section 02200.

C. Concrete vaults shall be removed to 3 feet below ground surface and filled with 2-sack slurry cement.

3.05 TITLE TO MATERIALS

A. All salvaged equipment and materials will remain the property of Owner.

B. With the exception of the following listed salvaged equipment, all items designated to be removed shall become the property of the Contractor.

1. None

C. Contractor shall be responsible for coordinating with the Owner and delivering salvaged equipment to the Owner's operations yard.

D. Title to equipment and materials resulting from demolition is vested in the Contractor upon approval by Engineer of Contractor's Demolition/Renovation Plan, and the resulting authorization by Engineer to begin demolition.

3.06 DISPOSITION OF MATERIAL

A. Do not remove equipment and materials without approval of Contractor's Demolition/Renovation Plan by Engineer.

3.07 REUSE OF MATERIALS AND EQUIPMENT

A. Removal and store materials and equipment as referenced in these Specifications to be reused or relocated to prevent damage, and reinstall as the work progresses.

3.08 UNSALVAGEABLE MATERIAL

A. All material shall be disposed of off the site.

B. UNIVERSAL WASTE LAMPS AND THERMOSTATS: Dispose of in strict accordance with 40 CFR 273.

3.09 CLEANUP

A. Debris and rubbish shall be removed and transported in a manner that prevents spillage on streets or adjacent areas. Local regulations regarding hauling and disposal shall apply.

END OF SECTION 02050

SECTION 02200
EARTHWORK AND SITE PREPARATION

PART 1 - GENERAL

1.01 DESCRIPTION

Requirements specified in Conditions of the Contract and Division 1 form a part of this Section. Provide labor, equipment, tools, materials, and services needed to accomplish all site preparation, earthwork and incidental appurtenant work as described herein or shown on the Drawings.

Work Included in This Section: Principal items are –

1. Site preparation, clearing and grubbing.
2. Preparation of fill areas.
3. Excavation and controlled fill construction.
4. Structural excavation, and backfills.
5. Pavement subgrade.
6. Disposal of surplus and/or unsuitable materials.
7. Dust control and drainage control.
8. Clean-up.

1.02 RELATED SECTIONS

A. TRENCHING, BACKFILLING AND COMPACTION: Section 02221

B. SHEETING, WALING, SHORING: Section 02415

1.03 DEFINITIONS

A. SITE: The property owned by, or under the jurisdiction of the Owner within the boundaries shown on the Drawings, easements and/or rights-of-way roads, drainage facilities, and pipelines, and the Contractor's working and storage areas adjacent to the facilities.

B. CONTROLLED FILL: Compacted suitable fill material in all areas of the site requiring filling to grade as shown on the Drawings.

C. CONTROL DENSITY FILL: One-sack cement slurry used to backfill areas where pipeline undercrossing make it difficult to mechanically compact fill materials.

D. STRUCTURAL FILL: Compacted suitable fill material which will support a structure or some part of a structure.

E. STRUCTURAL BACKFILL: Compacted suitable material placed between the wall of a structure and construction excavation slope up to finished grade.

F. SUITABLE MATERIAL: As specified herein shall be any material imported or excavated from the cut areas that is, in the opinion of the Owner, suitable for use in constructing fills.

G. WASTE EXCAVATION: Material from project excavations which is not suitable for use in backfill or compacted fills or is in excess of that required to be used for backfill or to construct fills.

1.04 SITE INVESTIGATION

A. SOIL INVESTIGATION REPORT: A specific geotechnical report was prepared for the nearby Wastewater Treatment Plant. Refer to Appendix A for additional information.

B. CONTRACTOR'S RESPONSIBILITY: The Contractor shall carefully examine the site and make all inspections necessary in order to determine the full extent of the work required to make the completed Work conform to the Drawings and Specifications. The Contractor shall satisfy himself as to the nature and location of the Work, conditions, the conformation and conditions of the existing ground surface, and the character of equipment and facilities needed prior to and during prosecution of the Work. The Contractor shall satisfy himself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered. Any inaccuracies or discrepancies between the actual field conditions and the Drawings, or between the Drawings and Specifications must be brought to the Owner's attention in order to clarify the exact nature of the Work to be performed.

C. EXISTING ELEVATIONS: All existing elevations shown on the plans are approximate only. The Contractor shall recognize and acknowledge the condition that the bid lump sum price shall include all earthwork activities irrespective of the possible localized difference in contour elevations and actual ground; and that there will be no additional compensation from the Owner for earthwork changes, engineering, or field staking in this regard.

1.05 SAFETY

The Contractor shall familiarize himself with, and shall at all times conform to, the regulations of the "OSHA General Industry Occupational Safety and Health Standards", and "OSHA Safety and Health Regulations for Construction Safety Orders" and "Trench Construction Safety Orders" of the State of California, Department of Industrial

Relations, Division of Occupational Health and Safety." A copy of these documents shall be kept on the job site.

1.06 ENVIRONMENTAL SAFEGUARDS AND REGULATIONS

The Contractor shall comply with regulations in force at all times to prevent pollution of air and water.

1.07 QUALITY ASSURANCE

A. BY CONTRACTOR: Exercise due care to assure procurement, storage and placement of materials from site or offsite sources which shall comply with the requirements, Specifications and standards set out herein. The Contractor may have, at his discretion, such tests and inspections as he may desire performed by qualified personnel or independent testing services, for his guidance and control of the Work.

B. BY OWNER: The Owner through its project representative(s), will be the onsite arbiter and judge of the acceptability of the Work done, based on such observations and tests he may require or perform.

The Owner may provide inspection and testing by its own representatives or by independent testing services, engaged and paid for by the Owner. In this regard, a Soils Engineer may be engaged by the Owner, who shall act as the direct representative of the Owner in soils work, to perform inspection of the removal and replacement of unsuitable materials, all excavations, and the placement and compaction of all fills and backfills within the limits of earthwork on this Project. Costs for all such inspections and tests will be paid by the Owner, except Contractor shall bear the cost of retest and reinspection of reworked faulty work.

C. APPLICABLE CRITERIA, TESTS AND STANDARDS:

1. For Site Earthwork - Rough graded surface ready to receive top soil, sod, or seed, crushed rock, or aggregate base shall be graded to + or - 0.1 feet of the Plan elevation, except where meeting curbs, walks, or building entrances, grade to + or - 0.05 feet of Plan. However, the acceptance of such irregularities shall not be construed to reduce the thickness of topsoil, sod or pavement. Permanent surface water courses shall be constructed to average Plan grades and shall drain completely throughout their length. Finish surfaces shall be + or - 0.05 feet of the Plan elevation, and all areas shall be finished so as to drain readily.

2. For Earthwork for Structures - The Owner will provide the services of a qualified Soils Engineer to make tests of prepared subgrade

and compacted fill. Testing will be at the discretion of the Soils Engineer. The Contractor shall give the Soils Engineer twenty-four (24) hours notice of the schedule commencement or subgrade preparation.

3. For Waste - Rubbish, debris, junk, material deemed unsuitable by the Owner from tests or visual inspection, and all material delivered to fill or embankment, which cannot be satisfactorily compacted, shall be removed from the project site and wasted in an area, provided by Contractor, that is acceptable to local authorities. Disposal of such materials shall be in accordance with all applicable laws, regulations, permits, and approvals from Owner of property upon which the material will be disposed.

4. For Clean-Up - Removal of all rubbish, debris, junk, temporary materials, and undesirable plants within the construction limits, restoration of staging areas and obliteration of temporary roads and stockpiles, and removal of trees damaged by the Contractor's operations shall be performed by the Contractor, to the satisfaction of the Owner as determined by visual inspection and is a condition for acceptance and final payment.

5. Standards for Soil Classification, Properties and Tests

   (a) Earthwork and Embankment (excluding roads):

      1. Classification - ASTM D-2487.
      2. Physical Properties - ASTM D854, D-2216
      3. Compaction - Modified Proctor ASTM D1557-91

   (b) Backfill for Trench:

      1. Classification - ASTM D2487
      2. Compaction - Modified Proctor ASTM D1557-91
      3. Field Density Test - ASTM 1556-82
         D2937-83, D2922-81 (As approved by Owner)

   (c) Structural Fill and Backfill:

      1. Classification - ASTM D2487
      2. Attenberg Limits - Plasticity Index and - Liquid Limit ASTM D4318
      3. Compaction - Modified Proctor ASTM D1557-91
      4. Physical Properties - ASTM D854, D2216
      5. Field Density Test - ASTM D1556-82

D2937-83, D2922-81 (As approved by Owner)

(d) Controlled Fills:

1. Classification - ASTM D2487
2. Physical properties - ASTM D854, D2216
3. Compaction - Modified Proctor ASTM D1557-91
4. CBR - ASTM D1883 (R-Value - ASTM 2844)
5. Field Density Test - ASTM D1556-82
   D2937-83, D2922-81 (As approved by Owner)

(e) Road Embankment:

1. Classification - ASTM D2487
2. Physical properties - ASTM D854, D2216
3. Compaction - Modified Proctor ASTM D1557-91
4. CBR - ASTM D-1883
5. Field Density Test - ASTM D1556-82
   D2937-83, D2922-81 (As approved by Owner)

(f) Borrow:

1. Classification - ASTM D2487.
2. Other properties - as determined by requirements at point of use.

1.08 COMPACTION

The maximum dry density, optimum moisture content and field density of each soil type used in the controlled compacted fill shall be determined as stated above.

1.09 INSPECTION

Observation and compaction tests shall be made by the Owner during the filling and compacting operations.

During the grading operation, continuous inspection may be made to assure that grading is performed in accordance with specified requirements. Should testing indicate unsatisfactory compaction, additional compactive effort shall be applied with the adjustment of moisture content until satisfactory compaction is obtained.

1.10 GUARANTEE

Work done under this Section shall in all respects come under the terms of the guarantee stated in the Conditions of the Contract.

PART 2 - PRODUCTS

2.01 MATERIALS

A. CONTROLLED FILL MATERIAL: Materials for controlled fill shall consist of any material imported or excavated from the cut areas that, in the opinion of the Owner, is suit-able for use in constructing fills. The material shall contain no rocks or hard lumps greater than 12 inches in size and shall contain at least 40 percent of material smaller than 3/4 inch in size. Materials greater than 6 inches in size shall be placed by the Contractor in windrows on a clean, over-excavated or unyielding compacted fill or firm natural ground surface. Select native or imported granular soil (sand equivalent greater than 30) shall be placed and thoroughly flooded over and around all windrowed rock, such that voids are filled. Windrows of oversize material should be staggered so that successive strata of over-sized material are not in the same vertical plane. No nesting or rocks shall be permitted. No material of a perishable, spongy, or otherwise of an improper nature shall be used in filling.

Material placed within 24 inches of rough grade shall be select material that contains no rocks or hard lumps greater than 6 inches in size and that swells less than 3 percent when compacted as hereinafter specified for compacted fill and when subjected to an axial pressure of 160 psf.

Representative samples of material to be used for fill shall be tested in the laboratory by the Soil Engineer in order to determine the maximum density, optimum moisture content and classification of the soil. In addition, the Soil Engineer shall determine the approximate bearing value of a recompacted saturated sample by direct shear tests or other tests applicable to the particular soil.

During grading operations, soil types other than those analyzed in the report of the soil investigation may be encountered by the Contractor. The Soil Engineer shall be consulted to determine the suitability of these soils.

B. STRUCTURAL FILL MATERIAL: Materials shall consist of crushed aggregate base, either imported or manufactured from excavated onsite rocky material.

The crushed aggregate base shall be uniformly graded and shall conform to State of California Standard Specifications Aggregate Base Class 2 with the following gradations:

AGGREGATE GRADING REQUIREMENTS
Percentage Passing
(California Test 202)

			3/4 Maximum Individual Test Results	Moving Average
1"	-	-	100	100
3/4"	45-90	50-85	87-100	90-100
No. 4	20-50	25-45	30-60	35-55
No. 30	6-29	10-25	5-35	10-30
No. 200	0-12	2-9	0-12	2-9

QUALITY REQUIREMENTS

Tests	California Test	Individual Test Result	Moving Average
Resistance (R-value) [1]	301	78 Min.	-
Sand Equivalent	217	28 Min.	31 Min.
Durability Index	229	35 Min.	-

[1] R-value testing may be waived if:
(1) a previous sample of the aggregate being supplied met the R-value requirements and had a Sand Equivalent value of 33 or more;
(2) the Sand Equivalent value of the sample being tested is not more than 5 points lower than the Sand Equivalent value of the sample that met the R-value requirements; and
(3) the aggregate has not been treated with lime, cement, or other chemical material.

All rock materials shall be clean, hard, sound, durable, uniform in quality, free of any detrimental quantity of soft, friable, thin, elongated or laminated pieces, disintegrated material, organic matter, oil, alkali or deleterious substance.

C. STRUCTURAL BACKFILL MATERIAL: Materials for structural backfill shall be as material used for controlled fill, 2.1.1, except the material shall contain no rocks or hard lumps greater than 12 inches in size.

Only non-expansive materials shall be used.

D. GRANULAR MATERIAL: Materials for granular material shall consist of a coarse mortar and conforming to ASTM C144.

E. SPECIAL CRUSHED ROCK BEDDING AND STRUCTURE FOUNDATION: When groundwater is encountered in the excavation and/or where indicated on the Contract Drawings, the material in the bottom of the trench or excavation shall be removed to a depth directed by the Owner and replaced with 3/4 inch maximum crushed rock bedding. The crushed rock bedding shall be installed and compacted per these specifications. The 3/4 inch maximum crushed rock material shall be approved by the Owner before use.

Crushed rock shall be the product of crushing rock or gravel. Fifty percent of the particles by weight retained on a 3/8-inch sieve shall have their entire surface area composed of faces resulting from fracture due to mechanical crushing. Not over 5% shall be particles that show no faces resulting from crushing. Less than 10% of the particles that pass the 3/8-inch sieve and are retained on the No. 4 sieve shall be waterworn particles. Gravel shall not be added to crushed rock. Crushed rock (3/4") shall have the following gradation:

Sieve Sizes	3/4-inch Max. Crushed Rock % Passing
1"	100
3/4"	90-100
1/2"	30-60
3/8"	0-20
No. 4	0-5
No. 8	-

For specified 3" crushed rock, Contractor shall submit gradation to Owner for review and approval.

Special Crushed rock Bedding or foundation material, where ordered by the Owner, shall be paid as indicated in the Bid Schedule and set forth in the Special Requirements.

PART 3 - EXECUTION

3.01 GENERAL

The Work performed under this Specification shall be constructed to the lines, grades, elevations, slopes and cross sections indicated on the Drawings, specified herein, and/or directed by the Owner. Slopes, graded surfaces, and drainage features shall present a neat uniform appearance upon completion of the Work.

It shall be the Contractor's responsibility (1) to maintain adequate safety measures and working conditions; and (2) to take all measures necessary during the performance of the Work to protect the entire project area and adjacent properties which would be affected by this Work from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material, until final acceptance by the Owner. It shall be the Contractor's responsibility to maintain completed areas until the entire project area is in satisfactory compliance with the job specification.

Utility lines and structures indicated on the Drawings which are to remain in service shall be protected by the Contractor from any damage as a result of his operations. Where

utility lines or structures not shown on the Drawings are encountered, the Contractor shall report them to the Owner before proceeding with the Work. The Contractor shall bear the cost of repair or replacement of any utility lines or structures which are broken or damaged by his operations.

3.02 REMOVALS, CLEARING AND GRUBBING

A. CLEARING: Clearing consists of the complete removal of objectionable materials and obstructions above and below the ground surface including tree stumps, brush, grass, vegetative matter and other objectionable materials within the project limits. All brush and organic material shall be removed before placing any earth fills. It shall be the Contractor's responsibility to save and protect all trees that lie outside the construction area. No trees shall be removed unless approved by the Owner.

B. GRUBBING: Grubbing consists of the complete removal of stumps, including tap roots or lateral roots 1-1/2 inches or more in diameter, and the removal of brush, grass or weeds to depths below the natural ground as specified herein. Stumps shall be grubbed to a depth of 3 feet and grass or weeds shall be grubbed to a depth of 6 inches below the natural ground surface, or to the depths as determined in the field by the Soil Engineer at the time of construction.

C. PROTECTION: Existing items not designated to be demolished or removed shall be protected from damage. Any such item damaged by the Contractor shall be restored or replaced immediately at the Contractor's expense.

D. DEBRIS AND WASTE MATERIAL: All debris and waste material resulting from demolition, clearing, and grubbing shall be removed from the site and disposed of by the Contractor.

3.03 DUST CONTROL

The Contractor shall take all steps possible to prevent and reduce dust arising from the construction activity. He shall have adequate water trucks on the site at all times and water, as necessary, the areas where dust may arise. He shall cooperate fully with the Owner and water immediately when instructed to do so.

3.04 CARE OF DRAINAGE WATER

Contractor shall take care of drainage water from the construction operations, and of storm water and/or wastewater reaching the construction area from any source, so that no damage will be done to the excavation, pipe or structures. The Contractor shall be responsible for any damages to persons or property on or off the construction site due to

such drainage water or to the interruption or diversion of such storm water or wastewater on account of his operations.

Such grading shall be done as may be necessary to prevent surface water from flowing into excavations, and any water accumulating therein shall be removed by pumping or by other reviewed methods.

Protection of the site during the construction shall be the responsibility of the Contractor. Completion of a portion of the project shall not preclude that portion or adjacent areas from the requirements for site protection until such time as the entire project is complete.

3.05 EXCAVATION

A. GENERAL: The Contractor shall perform all excavation necessary or required as shown on the Drawings. The excavation shall include the removal and disposal of all earth materials of whatever nature encountered, which shall include both rock excavation and common excavation when both are present, and shall include the furnishing, placing, and maintaining of shoring and bracing necessary to safely support the sides of the excavations. The Work shall also include all pumping, ditching and other required measures for the removal or exclusion of water.

B. EXCAVATION FOR STRUCTURES: Structure excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the Work. The removal of such materials shall conform to the lines and grades shown on the Drawings and/or herein specified. Temporary structure excavations shall at all times conform to the Requirements of the State of California, Division of Occupational Health and Safety, and pertinent requirements contained in referenced Geotechnical Investigation Report and Specification Section 02415, Sheeting, Waling and Shoring.

Continuous wall and isolated footings shall be underlain by a minimum compacted controlled fill thickness equal to 1.5 times the footing width or greater if indicated in the referenced Geotechnical Investigation Report. This zone of over-excavation, scarification and recompaction shall extend a minimum of five feet beyond the footing lines. Exposed surface shall be scarified, and brought to optimum moisture content and compacted to a minimum of 95 percent relative compaction.

All surfaces to receive concrete slabs-on-grade shall be underlain by a minimum compacted controlled fill thickness of 18 inches or greater if indicated in the referenced Geotechnical Investigation Report. This shall

be accomplished by combination of over-excavation and recompaction to 95% relative compaction.

Contingent upon locations, all surfaces to receive compacted fill shall be scarified, brought to near optimum moisture content and compacted to required percentage of relative compaction as specified herein.

Rough grade excavations for structures and footings will be inspected by the Owner to verify that the excavations extend into satisfactory soils and are free of loose and disturbed materials.

Foundation for tanks, pump vaults or subsurface chambers shall have structural fill material extending 12 inches, minimum, below the structural base slab to native material, which has been scarified and compacted to 95% relative compaction.

3.06 STRUCTURAL BACKFILL

A. PLACEMENT OF STRUCTURE BACKFILL: Before beginning back-filling, all foreign material, including water, shall be removed from the space to be backfilled and the area to be backfilled shall be inspected and approved by the Owner. Sloping sides of the excavated space shall be stepped to prevent wedging action of the backfill against the structure. No backfill shall be placed around or upon any structure until it is proven that the concrete has attained satisfactory strength in accordance with Section 03300 and that the structure as a whole is adequate to receive backfill. The compressive strength shall be determined by tests on representative cylinders cured under conditions similar to those prevailing at the site.

Backfill shall be placed in uniform layers on opposite sides of structures and walls before compaction. The Contractor shall inform the Owner of the sequence of backfilling to be followed around each structure and this sequence shall be reviewed by the Owner before any backfilling is placed.

B. COMPACTION OF STRUCTURE BACKFILL: Structure backfill shall be placed in horizontal layers of such depths compatible to the type of compaction equipment being used, but in no case shall the lifts exceed eight (8) inches. Each layer shall be evenly spread, the moisture content brought to near optimum conditions and then compacted. The density shall be as follows:

STRUCTURAL FILL COMPACTION

Type of Fill	Percent of Maximum Density of Optimum Moisture
Structural Fill Material	95
Structural Backfill Material	90

Backfill shall be mechanically compacted by equipment of a size and type reviewed by the Owner. Permission to use specified compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment shall not result in damage to adjacent ground, existing improvements, or improvements installed under the Contract.

Flooding, jetting or ponding shall not be permitted for the compaction of any structure backfill.

3.07 CONTROLLED FILL

A. GENERAL: Unless otherwise specified, fill material shall be compacted by the Contractor while at a moisture content near the optimum moisture content and to a density that is not less than 90 percent of the maximum density at optimum moisture.

Potentially expansive soils may be used in fills below a depth of 24 inches and shall be compacted at moisture content greater than the optimum moisture content for the material.

Slopes shall be 2:1 unless otherwise shown on the Plans. No slopes shall be constructed steeper than 2:1. Areas to receive fill shall be prepared as shown on the Plans and approved in writing by the Owner prior to placement.

B. PREPARING AREAS TO BE FILLED: All vegetable matter and objectionable material shall be removed by the Contractor from the surface upon which the fill is to be placed and any loose and porous soils shall be removed or compacted to a depth specified by the Soil Engineer. The surface shall then be plowed or scarified to a minimum depth of 6 inches until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

When placing fill in horizontal lifts adjacent to areas sloping steeper than 5:1 (horizontal: vertical), horizontal keys and vertical benches shall be excavated into the adjacent slope area. Keying and benching shall be sufficient to provide at least 6-foot wide benches and a minimum of 4 feet vertical bench height within the firm natural ground, firm bedrock or engineered compacted fill. No compacted fill shall be placed in an area

subsequent to keying and benching until the area has been reviewed by the Soils Engineer. Material generated by the benching operation shall be moved sufficiently away from the bench area to allow for the review of the horizontal bench prior to placement of fill. Typical keying and benching details shall be as shown on the Drawings.

After the foundation for the fill has been cleared, plowed or scarified, it shall be disced or bladed by the Contractor until it is uniform and free from large clods, brought to the proper moisture content and compacted as specified.

C. PLACING, SPREADING, AND COMPACTING FILL MATERIAL: The fill material shall be placed by the Contractor in thin layers that when compacted shall not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to obtain uniformity of material in each layer.

When the moisture content of the fill material is below that required by the Soils Engineer, water shall be added by the Contractor until the moisture content is as required for the specified compaction.

When the moisture content of the fill material is above that required by the Soils Engineer, the fill material shall be aerated by the Contractor by blading, mixing, or other satisfactory methods until the moisture content is as required for the specified compaction.

After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted by the Contractor to the specified density. Compaction shall be accomplished by sheepsfoot rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers or other types of acceptable compacting equipment. Equipment shall be of such design that it shall be able to compact the fill to the specified density. Compaction shall be continuous over the entire area and the equipment shall make sufficient passes over the material to ensure that the desired density has been obtained.

Compacted fill slopes shall be overbuilt and cut back to grade, exposing the firm, compacted inner core. The slopes shall be overbuilt a minimum of five feet. If the desired compaction is not achieved, the existing slope shall be over-excavated and reconstructed. The amount of overbuilding shall be increased until the desired compaction is achieved on the slope. The Contractor shall provide thorough mechanical compaction to the outer edge of the overbuilt slope surface. There shall be no excessive loose soil on the slopes.

The Contractor shall provide and maintain adequate erosion control facilities during the construction of the fill areas. The erosion control facilities shall be maintained in optimum condition until the permanent drainage system and vegetation is complete. The facilities shall be inspected following significant rainfall, repairs made and excess sediment removed. It shall be the Contractor's responsibility to prevent the discharge of sediment off-site or to adjacent water courses.

3.08 PAVEMENT SUBGRADE

All base course and AC pavement shall be underlain by a minimum 12 inch thickness of controlled compacted fill. In areas where less than 12 inches of fill or no filling is proposed, the existing grade shall be scarified and the moisture content adjusted to obtain optimum moisture content and recompacted to a depth of at least 18 inches. Compaction shall be a minimum of 95 percent of relative compaction.

3.09 CLEAN-UP

Upon completion of Work in this Section, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.

3.10 DISPOSAL OF SURPLUS AND/OR UNSUITABLE MATERIALS

Excavated materials which are determined by the Soil Engineer to be unsuitable for use in controlled fill, structural fill or structural backfill shall be disposed of, offsite, by the Contractor or in an area pre-approved by the Owner.

3.11 IMPORTATION OF SUITABLE FILL MATERIALS

In the event that sufficient quantities of excavated material are not available at the Contract work site, Contractor shall provide suitable material for controlled fills from an alternate source, as approved by Owner's Geotechnical Engineer. Include all associated costs in items provided on Bidding Sheet.

END OF SECTION 02200

SECTION 02221
TRENCHING, BACKFILLING AND COMPACTING

PART 1 - GENERAL

1.01 DESCRIPTION

Requirements specified in Conditions of Contract and Division 1 form a part of this Section. The Work of this Section includes all labor, machinery, construction equipment, and appliances to perform in a good workmanlike manner all trench excavation and backfill work shown on the Drawings and herein specified.

A. WORK INCLUDED IN THIS SECTION: Principal items included:
   1. Trench excavation, backfill and compaction.

B. RELATED WORK NOT INCLUDED IN THIS SECTION:

Item	Section
1.	Earthwork & Site Preparation 02200
2.	Sheeting, Waling & Shoring 02415
3.	Piping & Conduit Work specified in other Sections.

1.02 GENERAL REQUIREMENTS

Requirements of Section 02200 apply to this Section.

1.03 SAFETY

The Contractor shall familiarize himself with, and shall at all times conform to all applicable regulations of "Excavations, Trenching, and Shoring" of OSHA Safety and Health Regulations for Construction, "General Construction Safety Orders" and "Trench Construction Safety Orders" of the State of California, Department of Industrial Relations, Division of Occupational Health and Safety, and pertinent requirements of Soils Investigations Report referenced in Specification Section 02200 (if applicable) and applicable requirements specified in Section 02415.

1.04 INSPECTION AND CONTROL

A Soils Engineer may be engaged by the City, who shall act as the direct representative of the City in soils work, to perform inspection of the removal and replacement of unsuitable materials, and the placement and compaction of all fills and backfills within the limits of earthwork on this project. All work shall be done in accordance with these Specifications and as directed by the City. Costs for all such inspections and tests will be paid by the City. If retesting is required because the Contractor did not meet the Specification, the Contractor shall pay for all retesting.

1.05 REQUIREMENTS

A. GENERAL:

1. The Work performed under this Specification shall be constructed to the lines, grades, elevations, slopes and cross sections indicated on the Drawings, specified herein, and/or directed by the City in writing. Slopes, graded surfaces, and drainage features shall present a neat, uniform appearance upon completion of the Work.
2. It shall be the Contractor's responsibility (1) to maintain adequate safety measures and working conditions; and (2) to take all measures necessary during the performance of the Work to protect the entire project area and adjacent properties which would be affected by this Work from storm damage, flood hazard, caving of trenches and embankments, and sloughing of material, until final acceptance by the City. It shall be the Contractor's responsibility to maintain completed areas until the entire project area is in satisfactory compliance with the project Specifications.
3. Contractor shall be responsible for the excavation and disposition of unsuitable or surplus material by approved means of conveyance away from the working area.

B. UTILITY PROTECTION: Utility lines and structures indicated on the Drawings which are to remain in service shall be protected by the Contractor from any damage as a result of his operations. Where utility lines or structures not shown on the Drawings are encountered, the Contractor shall report them to the City before proceeding with the Work. The Contractor shall bear the cost of repair or replacement of any utility lines or structures which are broken or damaged by his operations.

PART 2 - PRODUCTS

2.01 MATERIALS

A. SELECT GRANULAR MATERIAL: Select granular material shall conform to the size gradation listed below. The use of other material shall be reviewed by the City prior to use. The City may require certification that the material meets the following gradation.

SELECT GRANULAR MATERIAL

Sieve Size	Percent Passing	
	Min.	Max.
3/4 inch	100	-
3/8 inch	80	90
No. 4	10	15
No. 8	0	5

B. SELECT BACKFILL MATERIAL: Select backfill material shall be material excavated from the trench. The material shall be free of rubbish, broken pavement, debris, stones greater than 4 inches in greatest dimension, organic mulch, or other deleterious materials. If the excavated trench material is unsuitable for backfill, other imported material shall be used, provided the material is reviewed by the City prior to import or placement. The imported material shall be select earth, sand, or gravel, conforming to the requirements for the material excavated from the trench and used for backfill.

C. CONCRETE: 3,000 psi compressive strength, minimum, as specified in Section 03300.

D. PIPELINES: Use materials shown on the Drawings and as specified in other pertinent Sections of this Specification.

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION

A. EXCAVATION FOR TRENCHES: Shall include the removal of all material of any nature for the installation of the pipe or facility and shall include the construction of trench shoring and stabilization measures, timbering and all necessary installations for dewatering.

B. MINIMUM WIDTH OF TRENCH: The minimum width of pipe trenches, measured at the crown of the pipe, shall not be less than 12 inches greater than the exterior diameter of the pipe, exclusive of bells and the minimum base width of such trench shall be not less than 12 inches greater than the exterior diameter of the pipe, exclusive of special structures or connections, and such minimum width shall be exclusive of all trench supports.

C. MAXIMUM WIDTH OF TRENCH: The maximum allowable width of trench for all pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 16 inches, and such maximum shall be inclusive of all timbers. A trench wider than the outside diameter plus 16 inches may be used without special bedding if the Contractor, at his expense, furnishes pipe of the required strength to carry the additional trench load. Such modifications shall be submitted for the City's review. Whenever such maximum allowable width of trench is exceeded for any reason, except as provided for on the Plans or in the Specifications, or by the written direction of the City, the City may, at its discretion, require that the Contractor, at his own expense for all labor and

materials, cradle the pipe in 2500 psi compressive strength concrete, or other approved pipe bedding.

D. MAXIMUM LENGTH OF OPEN TRENCH: Except by special permission by the City only that amount of open trench shall be permitted, which shall allow for that amount of pipeline construction, including excavation, construction of pipeline, and backfill in any one location, which can be completed in one day; however, maximum length of open trench shall never exceed 600 feet. This length includes open excavation, pipe laying and appurtenant construction and backfill which has not been temporarily resurfaced.

E. TRENCH SIDE SLOPES:
1. Temporary trench excavations shall at all times conform to the safety requirements hereinbefore specified in Paragraph entitled "Safety".
2. Loose cobbles or boulders shall be removed from the sides of the trenches before allowing workmen into the excavation, or the trench slopes must be protected with screening or other methods. Trench side slopes shall be kept moist during construction to prevent local sloughing and raveling. Surcharge loads due to construction equipment shall not be permitted within 8 feet of the top of any excavated slope.
3. If the Contractor elects to shore or otherwise stabilize the trench sides, he shall file with the City copies of drawings for same prepared and signed by a Civil Engineer duly registered in the State of California before commencing excavation.

F. EXCESS TRENCH EXCAVATION: If any trench, through the neglect of the Contractor, is excavated below the bottom grade required, it shall be refilled to the bottom grade, at the Contractor's expense for all labor and material, with select granular material compacted to a firm stable foundation.

3.02 BRACING TRENCHES

The sides of the trenches shall be supported with plank sheeting and bracing in such a manner as to prevent caving of the sides of the trench. Space left by withdrawal of sheeting or shoring shall be filled completely with dry granular material blown or rammed in place. All trenches deeper than 5 feet shall be shored unless cut to the angle of repose of the excavated soils.

3.03 PIPING BEDDING

The Contractor shall excavate to 4 inches below the bells or couplings for the full width of the trench and shall place four (4) inches of select granular material upon which the pipe is to be laid. In cases, as determined by the City where trench material is suitable for

use as bedding, the trench may be excavated to a point above the invert grade, and the trench bottom hand-shaped so that the bottom segment of the pipe is firmly supported on undisturbed material.

At pipe subgrade, if foundation soil in trench is soft, wet, spongy, unstable or does not afford solid foundation for pipe, the Contractor shall excavate as directed by the City and provide stable base by excavating any unsuitable material 24" minimum below the subgrade base or as the City decides is necessary for placement of pipe bedding.

Where rock is encountered in the trench, the Contractor shall excavate to a minimum 18 inch depth below subgrade or as the City decides is necessary, and shall construct a base by placing select granular material upon which a subgrade can be prepared.

Before any pipe is lowered in place, the trench bottom shall be prepared so that each pipe shall be supported for the full length of the barrel with full bearing on the bottom segment of the pipe equal to a minimum of one-half of the pipe OD, and a width equal to the trench width. All adjustments in line and grade shall be made by scraping away or filling and tamping in under the barrel of the pipe. Wedging or blocking is not permitted.

The pipe bedding shall be compacted to a minimum of 90 percent relative compaction as herein after specified.

3.04 BACKFILLING PIPE TRENCHES

A. BACKFILLING PIPE ZONE: Backfill material for the pipe zone shall consist of select granular material as specified in paragraph 2.01.1. Place material in the trench simultaneously on each side of the pipe for the full width of the trench and the depth of the pipe zone in layers 6 inches in depth. Each layer shall be thoroughly compacted by tamping. In all cases, backfilling of the pipe zone must be done by hand. Particular attention shall be given to underside of the pipe and fittings to provide a firm support along the full length of the pipe. The pipe zone shall be considered to extend 12 inches above the top of the pipe, and shall be compacted in the trench to a relative compaction of not less than 90 percent as herein after specified. Care shall be taken not to damage pipe or special coatings on the pipe.

1. Use of Material other than those specified shall be reviewed by the City prior to use. The Contractor shall bear all cost of removal of rejected material, its hauling to an authorized disposal site, and cost of providing required material to complete the bedding and backfilling.

B. BACKFILLING PIPE TRENCH: After the pipe has been laid in the trench and has been inspected and approved, and backfilling in the pipe zone is complete and compacted, the remainder of the trench may be

backfilled. The backfill material shall be select backfill material as specified in paragraph 2.1.2. Care shall be taken to ensure that no voids remain under, around or near the pipe.

1. Whenever imported borrow for backfill is required, the Contractor shall furnish this borrow material and dispose of the excess trench excavation and shall include the expense of this work in his bid.

C. COMPACTION: The maximum dry density and optimum moisture content of each soil type used in the controlled compacted fill shall be determined by ASTM D-1557-91. Field density tests shall be determined in accordance with ASTM D1556-82, ASTM D2937-83, D2922-81.

D. PLACEMENT AND COMPACTION OF TRENCH BACKFILL: The placement and compaction of all trench backfill shall conform to one of the following methods subject to the qualification specified therein:

1. Mechanically Compacted Backfill: With review of City backfill shall be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers to 90 percent relative compaction except that backfill compaction for trenches above the pipe zone shall be to a minimum 95 percent in areas under buildings and pavements. Where the backfill soil has a clay-like behavior and has a plasticity index of at least 12, only the upper 3 feet of material placed shall require minimum compaction of 95 percent. Impact-type pavement breakers (stompers) shall not be permitted over any pipe. Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements, or improvements installed under the Contract. The Contractor shall make his own determination in this regard. Mechanically compacted backfill shall be placed in horizontal layers not exceeding eight inches. Each layer shall be evenly spread, the moisture content brought to near optimum condition and then tamped or rolled until the specific relative compaction has been attained.

3.05 CENTRAL PIPELINE INSTALLATION REQUIREMENTS

A. DEPTH OF PIPE: Unless otherwise shown on the Plans, all pipelines shall have a coverage of at least 36 inches between the top of the pipe and the finished surface. All gravity line invert elevations and locations shown are intended to be exact and any change in alignment and grade may only be made with the review of the City. All force and gravity mains shall have 1 foot vertical clearance between themselves and all other utilities.

At all water main crossings, both gravity and force mains shall have 20 linear feet of concrete encasement centered at the crossing.

B. CHANGES IN LINE AND GRADE: In the event obstructions not shown on the Plans are encountered during the progress of the Work which will require alterations to the Plans, the City will issue the necessary changes to the Plans and order the necessary deviation from the line or grade. The Contractor shall not make any deviation from the specified line and grade without prior review by the City. Should any deviations in line and grade be permitted by the City in order to reduce the amount of rock excavation or for other similar convenience to the Contractor, any additional costs for thrust blocks, valves, air and vacuum valve assemblies, blow-off assemblies, extra pipe footage, concrete, sewer structures, or other additional costs shall be borne by the Contractor.

1. Contractor shall include in his Bid provisions to cover any deviation from the invert grade shown on the Plans to facilitate extra depth required to eliminate possible conflicts between culverts and other utilities with the force and sewer mains.

C. INSTALLING PIPE: Contractor shall, after excavating the trench and preparing the proper bedding for the pipe, furnish all necessary facilities for properly lowering and placing sections of the pipe in the trench without damage and shall properly install the pipe. The section of pipe shall be fitted together correctly and shall be laid true to line and grade bedding material, but if the pipe has a projecting bell, suitable excavation shall be made to receive the bell which shall not bear on the subgrade. The requirements for closely fitting the bottom of the pipe to the bedding material for the width shown on the Drawings shall be strictly enforced.

1. Pipe shall be laid up grade. Any pipe which is not in true alignment, both vertical and horizontal, or shows any undue settlement after laying shall be replaced when so ordered by the City. No pipe shall be laid which is damaged, cracked, checked or spalled or has any other defect deemed by the City to make it unacceptable, and all such sections shall be permanently removed from the Work.
2. At all times when the Work of installing pipe is not in progress, all openings into the ends of the pipelines shall be kept tightly closed with suitable plywood or sheet metal bulkheads to prevent the entrance of animals and foreign materials and to prevent water from entering the pipe.
3. Keep the pipe trench free from water at all times and take all necessary precautions to prevent the pipe from floating due to water entering the trench from any sources. Any damage is the Contractor's full responsibility. Restore and replace the pipe to its specified conditions and grade if it is displaced due to floating.

4. All pipelines adjoining concrete structures (including manholes) shall have a flexible joint within 36 inches from the face of such concrete structures. Flexible joints shall be installed on all pipe 4" and larger whether a flexible joint is shown on the Drawings or not. Where the flexible joint is shown on the Drawings, install the joint at the location shown.

3.06 CLEANUP

Immediately upon completion of Work of this Section, all rubbish and debris shall be removed from the job site. All construction equipment and implements of service shall be removed and the entire area involved shall be left in a neat, clean and acceptable condition.

END OF SECTION 02221

SECTION 02415
SHEETING, WALING AND SHORING

PART 1 - GENERAL

1.01 DESCRIPTION

Requirements specified in the Conditions of the Contract and Division 1 form a part of this Section. Provide protective installation consisting of shores, wales, braces, posts, piling, sheeting, anchorages and fastenings, both temporary and permanent, for accomplishment and protection of Work.

A. WORK INCLUDED IN THIS SECTION: Principal items included:
   1. Shoring and sheeting for structure excavation.
   2. Temporary sheeting and bracing for pipeline work as required.
   3. Materials for permanent sheet and bracing.

1.02 QUALITY ASSURANCE

A. MATERIAL STANDARDS: Furnish lumber for shores, wales, and sheeting of grading required by the American Lumber Standards for the particular application.

1.03 SUBMITTALS

Contractor shall submit complete calculations of the sheeting system including sizing of sheeting wales, rakers, anchor system, struts, earth anchors, anchor piles, tie rods or any other components pertinent to the design prior to the start of any Work involving sheeting and bracing. All designs submitted shall be signed by an engineer duly registered in the State of California.

1.04 JOB CONDITIONS

Buried debris may be found at some locations. Federal and local requirements for safety of job personnel and public will apply to work under the Section.

1.05 ALTERNATIVES

The use of application of alternative methods and materials, and the employment of proprietary systems under lease or franchise in lieu of that specified herein, may be allowed. Demonstration of suitability and compliance with these Specifications will be required.

PART 2 - PRODUCTS

2.01 MATERIALS

A. LUMBER:

1. Temporary Shores, Wales and Sheeting: Furnish structural grade planks, beams, and posts as defined and specified for stress-grade lumber in the American Lumber Standards. Lumber may be rough, untreated, in random lengths, and shall be of standard dimensions.
2. Permanent Sheeting: When permanent sheeting is called for on the Drawings, provide and install planks, beams, posts and timbers of unseasoned, rough, new southern yellow pine or Douglas Fir meeting the requirements of ASTM Standard D25, Class "C". In lieu of the above, lumber dressed to standard dimensions, dried and treated in accordance with Standard T-3 of the American Wood Preservers' Association may be utilized.

B. FASTENINGS: Provide fastenings for permanent sheeting as recommended in the National Design Specification for stress-grade lumber and its fastening.

PART 3 - EXECUTION

3.01 INSTALLATION

Install sheeting and bracing for trench and structure excavation progressively as the removal of excavated material requires. Butt planks to exclude groundwater and fines, preventing the erosion of voids outside sheeting. In soft, wet ground drive sheeting to a lower level as excavation progresses to that sheeting is embedded in undisturbed earth. Bracing of sheet piling may be permitted to penetrate the structural concrete only as directed by the City. Refer to Section 03300. Install wales and struts at close intervals so as to prevent displacement of the surrounding earth and to maintain safe conditions in the Work area. Any damage proven to result from improper installations shall be the responsibility of the Contractor. Temporary sheeting for trench and structure excavation may be removed and reused. Withdraw individual planks alternately as the backfill is raised, maintaining sufficient sheeting and bracing to protect the Work and workmen. Remove bracing completely. Where unstable conditions occur in the underlying strata from any cause, and withdrawal of sheeting will endanger the Work, a portion of the sheeting, including bracing, may be left in place with approval of the City. Remove all wood within a zone extending four (4) feet below finished grade. Leaving such material in place shall not be cause for an increase in Contract price.

END OF SECTION 02415

SECTION 02510
ASPHALT CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

Requirements specified in Conditions of the Contract and Division 1 form a part of this Section. Provide labor, equipment, tools and materials to accomplish asphalt concrete paving as indicated on the Drawings and/or on the Bidding Sheet.

A. RELATED WORK NOT INCLUDED IN THIS SECTION:

1. Earthwork and Site Preparation, Section 02200.

1.02 REFERENCE SPECIFICATION

Asphalt concrete paving work shall be in accordance with State of California, Department of Transportation Standard Specifications, Latest Edition.

1.03 PAVEMENT REMOVAL AND REPLACEMENT

A. GENERAL: Pavement removal and replacement for all public roads, including aggregate base and temporary paving where required, shall comply with all the requirements of the agency issuing the Encroachment Permit. In roads established under formation of a special road district, the specifications of the Encroachment Permit shall apply. Any private roads and streets, including driveways in which the surface is removed or damaged, shall be restored to the original grade and crown by the Contractor in accordance with the paving requirements described herein. Removed or damaged sections shall be restored with the type of improvements (or better) conforming to that which existed at the time the Contractor entered upon the work.

It shall be the responsibility of the bidder to satisfy himself as to the existing pavement sections prior to submitting his bid.

B. PAVEMENT CUTTING: Pavement shall be cut to a straight edge parallel to the pipe alignment prior to excavation. Method of pavement cutting shall be as specified by the agency having jurisdiction or as approved by the Owner. Under no circumstances shall excavation be started prior to scoring of pavement. If the adjacent pavement is disturbed during the Contractor's operation, the pavement shall be recut on a straight line to remove the damaged pavement before resurfacing. Portland cement concrete pavement and sidewalk shall be saw cut.

C. ASPHALT CONCRETE CAP: Where required by the agency issuing the Encroachment permit or other agency having jurisdiction, and where specified in the Contract Documents, an asphalt concrete cap shall be placed along the length of the trench. The installation of the asphalt concrete cap shall be in accordance with the specifications and policies of the agency having jurisdiction. Where the asphalt concrete cap is not specifically stated in the applicable permit or on the drawings, and when directed by the Owner, the minimum cap shall be a non-feathered 1-inch thick, 12-foot wide section centered over the center of the trench or the traveled way, and pulled with a "Barber Greene" or equivalent. Grind existing AC pavement at edges of the cap to the depth of the AC cap.

1.04 PAYMENT

Payment for asphalt paving (new or replacement) shall be on a lump sum, linear foot, square foot or per ton basis as indicated on the bidding sheet. Where payment for A.C. paving is indicated to be on a per ton basis, certified quantity tickets (tons) shall be provided to the Owner's inspector on the job site as the material is delivered and signed so as to certify delivery and acceptance. Any material for which asphalt concrete quantity tickets are not submitted as the material is delivered will not be accepted. Payment for asphalt concrete designated to be on a per ton basis will be based only upon tickets accepted by the Owner's inspector.

PART 2 - PRODUCTS

2.01 ASPHALT CONCRETE PAVING

A. MIX: Plant mix, Grade AR-4000.

B. THICKNESS: 4" min.; or greater where specified.

C. AGGREGATE SIZE: 1/2" maximum, medium per Caltrans Section 39.

D. ASPHALT CONTENT: 5% to 8% by weight.

F. PRIME COAT: Per Caltrans Section 39-4.02.

2.02 ASPHALT CONCRETE CAP

A. MIX: Plant mix, Grade AR-4000.

B. THICKNESS: 1" (Nominal minimum); or greater where specified.

C. AGGREGATE SIZE: 3/8" maximum, fine.

2.03 FOG SEAL

A. SPECIFICATION: Caltrans Section 37.

B. MATERIAL: Slow setting, mixing type asphaltic emulsion per Caltrans Section 94-1.01B.

2.04 ASPHALT CONCRETE BERMS

PART 3 - EXECUTION

3.01 ASPHALT CONCRETE PAVING

A. APPLICATION: Mixing transporting and placing of asphalt concrete shall be in accordance with all applicable provisions of Caltrans Section 39. Asphalt concrete shall not be placed when the atmospheric temperature is below 60° F, or during unsuitable weather.

B. REDWOOD HEADERS: Provide 2"x4" redwood headers for all pavement edges.

C. REPAIRS: Deficient paving and/or low areas with inadequate drainage; and damaged paving due to subgrade failure, inadequate trench compaction, etc. shall be repaired by the Contractor at no additional cost to the Owner.

3.02 ASSOCIATED PAVING RELATED WORK

A. MANHOLE COVERS: Adjust sewer and storm drain manhole covers to grade.

B. VALVE COVERS: Adjust water valve cans and covers to grade immediately after placement of the asphalt concrete cap in accordance with Owner requirements.

C. STRIPING: Replace the traffic striping and pavement markers over the areas receiving the overlay.

D. TRAFFIC SIGNAL LOOPS: Replace any damaged or removed traffic signal detector loops.

E. PAYMENT: Payment for all associated paving related work as described herein shall be included in the appropriate bid item(s) indicated on the Bidding Sheet and no additional compensation shall be made therefore.

3.03 FOG SEAL

A. APPLICATION: Apply fog seal at a rate of 0.06 to 0.10 gallons per square yard of surface area.

B. FOG SEAL SCHEDULE: Apply fog seal not less than fourteen (14) days following placement of asphalt concrete surfacing.

3.04 PAVING SCHEDULE

Unless otherwise approved by the Owner, all permanent paving shall commence only after construction of all other contract work is completed.

END OF SECTION 02510

SECTION 02620
EXISTING UNDERGROUND UTILITIES

PART 1 - GENERAL

1.01 DESCRIPTION

Requirements specified in conditions of the Contract and Division 1, 2 and 15 form a part of this Section. Provide work related to existing underground utilities as set forth herein.

A. WORK INCLUDED IN THIS SECTION: Principal items are:
   1. Exposure of existing utilities.
   2. Advance notification of utility agencies.
   3. Crossing, protection and/or relocation of utilities.
   4. Protection of other existing facilities.

B. RELATED WORK NOT INCLUDED IN THIS SECTION: Site Utilities, Section 02610.

1.02 EXPOSURE OF UTILITIES IN ADVANCE OF WORK

A. DETERMINATION OF LOCATION AND DEPTH:
   1. Determine the true location and depth of all utilities and service connections; including the type, material, and condition of any utility which may be affected by or affect the work.
   2. Coordinate with all utility companies field locate all underground lines before start of construction.

B. EXPOSURE IN ADVANCE OF TRENCHING:
   1. Expose all utility mains that must be crossed or closely paralleled at least 1500' in advance of construction.
   2. Contractor shall immediately after field location, provide the location and depth of the "potholed" utilities to the Engineer.
   3. Expose all service connections before excavation in the area.
   4. All cost incurred in exposing utilities shall be borne by the Contractor.

C. RIGHTS TO MINOR ADJUSTMENTS IN DESIGN: The City reserves the right to make minor adjustments in pipeline alignment and grade, all at no additional cost to the City.

D. COMPLIANCE: Failure of the Contractor to comply with the provisions described herein will result in an order to suspend work until these provisions are complied with, and no additional compensation will be allowed as a result of such suspension.

1.03 ADVANCE NOTIFICATION OF UTILITY AGENCIES

1. Determine and notify those agencies requiring advance notification for inspection or other purposes before beginning construction in any area of concern to said agency.
2. Provide agencies with 48 hours minimum advance notice.

1.04 CROSSING PROTECTION AND/OR RELOCATION OF UTILITIES

A. GENERAL: Utilities for the purpose of these specifications shall be considered as including, but not limited to, and irrespective of ownership; Pipelines (including irrigation mains), conduits, transmission lines, and appurtenances of Public Utilities" (as defined in the Public Utilities Act of the State of California) and those of private industry, business, or individuals solely for their own use or for use of their tenants; and storm drains, sanitary sewer, street lighting, traffic signal systems, duct banks, telephone cable, transmission cables, and completely buried structures.

B. UTILITIES INDICATED ON DRAWINGS:

1. Indicated utilities are based upon the information provided by the utility company to the Engineer; and the accuracy and completeness of the utilities shown is not guaranteed.
2. The depth indicated in profile, unless a specific elevation is shown, is based on general practice and is not guaranteed at any specific location.
3. No service connections are shown on the Drawings. Contractor to determine the exact location of all utilities and their service connections. All costs to be included in bid items provided on Bidding Sheet, and no additional compaction will be made.

C. FIELD LOCATING:

1. Contractor shall have utility companies field locate their utilities prior to construction.
2. Where required, field location by Contractor forces shall be included in the contract price for which such work is appurtenant to and no additional allowance will be made therefor.
3. The Contractor shall make his own investigation as to the location and type of existing utilities and their appurtenances and service connections which may be affected by the contract work, and shall notify the City as to any utility located by him which has been incorrectly shown or omitted from the drawings.

D. UTILITIES ON PLANS AND NOT IN CONFLICT:

1. Where utilities cross or parallel the pipeline trench but do not conflict with the permanent work to be constructed, the Contractor shall protect the utility in place unless otherwise indicated on the plans.

2. Unless otherwise provided in the specifications, full compensation for crossing or paralleling of utilities shown on the plans shall be included in the contract unit price for which such work is appurtenant thereto and no additional allowance will be made therefor.

E. SPECIAL WATER/SEWER CROSSINGS:

1. At the locations shown on the plans or if the vertical separation between the outside of the sewer pipe and the outside of existing water pipes at crossings is less than one (1) foot, and when directed by the City, the Contractor shall provide the construction required per the detail shown on the plans and per the State Health Department Water/Sewer Special Construction Requirements. The special construction will be deleted at locations shown if the vertical separation is 1 foot or greater.
2. The City hereby reserves the right to increase or decrease this item from the quantity shown on the Proposal forms without altering the unit price bid per each. Payment will be made in accordance with the unit bid price provided on the Bidding Sheet; in the event no item for said special construction work is designated on the Bidding Sheet, Contractor shall be paid under the "Extra Work" provisions of the Contract Appendix.

F. RELOCATION OF UTILITIES BY THE CONTRACTOR FOR HIS OWN CONVENIENCE: The temporary relocation or the alteration of any utility desired by the Contractor solely for his own convenience in the performance of the contract work, to a position or condition other than that provided for in the specifications or shown on the drawings, shall be the Contractor's own responsibility, and he shall make all arrangements with the property owners regarding such work. Any costs of such work for the Contractor's own convenience shall be absorbed in the unit prices or included in the lump sum amounts bid for the various contract items.

G. UTILITY CONFLICTS WITH PROPOSED IMPROVEMENTS

1. If a utility, whether shown on the plans or not, should intersect the proposed improvement at grade anywhere along the line of the improvement, the Contractor shall immediately notify the City.
2. Contractor shall notify the City in writing, stating the nature of the conflict, location by schedule, sheet number, name of the street or location of easement and the station at which the conflict occurred. The City will, within a reasonable time, make the necessary arrangements to resolve the conflict.
3. Completion of any required "gap" after the resolution of a conflict shall not be just cause for additional compensation. Such completion of the "gap" shall be started within 72 hours after the Contractor has been notified of resolution of the conflict and

completed in a workmanlike manner within reasonable time thereafter.

4. When directed or approved by the City, changes in line or grade of any structure being built may be made in order to avoid utilities. Any additional costs because of such changes will be paid for as "Extra Work".
5. When a utility shown on the plans conflicts with the proposed improvements, the City will arrange for the relocation or alteration of said utility or require the Contractor to do same as 'Extra Work". Work required in connection with unknown utilities will be performed and paid for as specified in the following paragraphs.

H. UNKNOWN UTILITIES DISCLOSED DURING CONTRACT WORK: In the event that a utility is disclosed or installed subsequent to the award of contract, such utility not being indicated on the drawings, the alteration, relocation or proper support and protection shall be done and paid for as follows:

1. When said utility is found to occupy the space required to be occupied by a part of the permanent works to be constructed under the Contract, the City will arrange for the relocation or alteration of said utility, or require the Contractor to do same as "Extra Work".
2. When the said utility is found to lie parallel to the permanent work and within the trench prism defined by the minimum allowable trench excavation consistent with safety and the rules, orders and regulations of local, State and Federal agencies having jurisdiction; the City will arrange for the relocation, protection or alteration of said utility, or require the Contractor to do same as "Extra Work".
3. When said utility is more or less parallel with, and any portion of it does not lie within the trench prism specified hereinabove, the Contractor shall advise the City thereof, and in cooperation with the City of the utility, provide and place the necessary support, if any, for proper protection to ensure continuous and safe operation of the utility. All costs of such work shall be borne by the Contractor.
4. Utilities found to cross the excavation but not intercepting the permanent works to be constructed, then the Contractor will be required to protect the existing facility in place and construct the proposed facility under the unknown utility.

   Compensation for such crossings will be at a unit price per each in accordance with the proposal therefor. The number of such crossings is estimated and the City hereby expressly reserves the right to add to the number shown or decrease from the number shown or to totally delete the item for unknown utility crossings at no change in the unit price per each. The time extension for such crossings shall be determined by the City and shall be added t o the

total time for completion allowed and for which no liquidated damages will be assessed.

5. Upon disclosing a utility in the course of excavation that was not indicated on the drawings or marked in the field, the Contractor shall protect it in place. However, he shall immediately investigate if it is abandoned. The Contractor will be compensated at the bid unit price for unknown utility crossings only for the initial crossing of abandoned lines; and only if he did protect the abandoned utility in place.

I. RESPONSIBILITY OF THE CONTRACTOR:

1. The Contractor shall be responsible for all costs for the repair of any and all damage to the contract work or to any utility (whether previously known or disclosed during the work), as may be caused by his operations.
2. Utilities not shown on the drawings to be relocated or altered by others, shall be maintained in place by the Contractor.
3. At the completion of the contract work, the Contractor will leave all utilities and appurtenances in a condition satisfactory to the utility owners and the City.

1.05 PROTECTION OF FACILITIES OTHER THAN UTILITIES

Contractor shall protect in place or remove and replace to original condition all existing facilities.

It shall be the Contractor's responsibility to familiarize himself with the conditions of proposed work and to identify by field investigation those features, whether or not shown on the plans, which require removal and replacement or protection in place These features include, but are not limited to, fences, cross gutters, roads, sidewalks, driveways, curbs and gutters, power poles, signs, drainage structures, trees, landscaping, etc.

END OF SECTION 02620

SECTION 02647
POLYVINYL CHLORIDE (PVC) SEWER PIPE AND DUCTILE IRON PIPE

PART 1 – GENERAL

1.01 DESCRIPTION

This section includes materials, installation, and testing of PVC sewer pipe and Ductile Iron pipe. Size range is 4- to 24-inch nominal pipe size.

1.02 RELATED WORK SPECIFIED ELSEWHERE

The work of the following sections also applies to the work of this section. Other sections, not referenced below, shall also apply to the extent required for proper performance of this work.

A. Section 03300 – Cast-in-Place Concrete

1.03 SUBMITTALS

A. Submit shop drawings in accordance with the Contract General Conditions.

B. Provide affidavit of compliance with ASTM designation F679, PS 115.

C. Submit copies of the following manufacturer required tests conducted on the project pipe:

1. Quick-burst strength of pipe.

2. Flattening resistance of pipe.

3. Impact resistance of pipe.

4. Acetone-immersion test of pipe material.

5. Internal pressure and vacuum tests of joints per ASTM D 3139.

6. Laboratory tests of gaskets per ASTM F 477.

7. Record of additional tests after test sample failure.

D. Submit manufacturer's literature on ductile iron pipe and fittings including dimensions, thickness, weight, coating, lining, and statement of inspection and compliance with the acceptance tests of AWWA C110 or C153. Submit copy of report of pressure tests for qualifying the designs of all

sizes and types of AWWA C153 fittings that are being used in the project. The pressure test shall demonstrate a minimum safety factor of three times the rated working pressure as described in AWWA C153, Section 5.5.

E. Submit manufacturer's catalog data and descriptive literature for high deflection couplings, repair couplings, service saddles, restrained joints, tracer wire, marking tape, and miscellaneous piping materials.

F. Submit manufacturer's catalog data and installation instructions for restrained joint system. Include torque limitations and assembly tolerances.

1.04 INSPECTION AND FIELD VERIFICATION

A. The Owner's authorized representative may inspect materials, productions, and testing at manufacturer's plant.

B. Where new pipelines are to be connected to existing pipelines of the Owner, the Contractor shall verify in the field the location, elevation, bearing, inclination, pipe material, pipe outside diameter, and any other characteristics of the existing pipeline before proceeding with the pipe installation. This field verification shall be performed in the presence of the Owner's representative. Field verification and potholing shall be performed sufficiently ahead of schedule to allow time for design revision if necessary. The Contractor shall adjust and align the new piping as necessary to meet the field conditions and provide all required material, labor and equipment to make the connection.

PART 2 – MATERIALS

2.01 POLYVINYL CHLORIDE PLASTIC PIPE

General

Polyvinyl Chloride (PVC) Plastic Pipe. PVC solid wall pipe (15-inch diameter and smaller) shall meet the requirements of ASTM designation D-3034, SDR 26. Polyvinyl Chloride (PVC) Plastic Pipe. PVC solid wall pipe (18-inch diameter and larger) shall meet the requirements of ASTM designation F679, PS 115.

Joints

A. PVC Pipe Gasketed Joint Assembly. The assembly of the gasketed joint should be performed as recommended by the pipe manufacturer. The elastomeric gaskets may be supplied separately in cartons or prepositioned in the bell joint or coupling at the factory. When gaskets are color coded, be sure to consult the pipe manufacturer or his literature for the significance. In all cases, clean the gaskets, the bell or coupling interior,

especially the groove area (except when gasket is permanently installed) and the spigot area with a rag, brush or paper towel to remove any dirt or foreign material before the assembling. Inspect the gasket, pipe spigot bevel, gasket groove, and sealing surfaces for damage or deformation. When gaskets are separate, use only gaskets which are designed for and supplied with the pipe. Insert them as recommended by the manufacturer. Lubricant should be applied as specified by the pipe manufacturer. Bacterial growth, damage to the gaskets or the pipe, may be promoted by use of nonapproved lubricants. Use only lubricant supplied by the pipe manufacturer. After lubrication, the pipe is ready to be joined. Good alignment of the pipe is essential for ease of assembly. Align the spigot to the bell and insert the spigot into the bell until it contacts the gasket uniformly. Do not swing or "stab" the joint; that is, do not suspend the pipe and swing into the bell. When field-cut is necessary, a square cut is required. Use a factory-finished beveled end as guide for proper bevel angle and depth of bevel plus distance to the insertion reference mark.

B. PVC Solvent-Cemented Joint Assembly. Solvent-cemented joints should be made in accordance with manufacturer's recommendations or in accordance with ASTM D-2855, Standard Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

2.02 DUCTILE IRON PIPE AND FITTINGS

A. All fittings for PVC pressure pipe shall be ductile iron as specified herein. All ductile iron pipe spools shall be the class specified on the Drawings.

B. Provide ductile iron fittings conforming to AWWA C110 with a minimum rated working pressure of 350 psi. Ductile iron pipe shall be rated for a working pressure of 350 psi or shall be the pressure class as shown on the Drawings. Provide fittings with bells and gaskets specifically designed for cast iron equivalent outside diameter PVC pipe. Use mechanical joint fittings or fittings with bells and gasket ends.

END OF SECTION 02647

DIVISION 3

CONCRETE

DIVISION 3
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SECTION 03110

CONCRETE FORMWORK

PART 1 - GENERAL

1.01 SCOPE

The work includes the furnishing and installing and removing of forms for all cast-in-place concrete work as shown and noted on the drawings and specified herein.

1.02 CODES AND STANDARDS

The American Concrete Institute's "Recommended Practice for Concrete Formwork", ACI 347-63, and the "Uniform Building Code", 1991 Edition, Section 2606, are hereby made a direct part of this specification, and all concrete formwork included in this contract shall conform with the applicable requirements therein except as specified otherwise herein.

1.03 RELATED SECTIONS

A. SECTION 02200: Earthwork and Site Preparation

B. SECTION 03210: Concrete Reinforcement

C. SECTION 03300: Cast-in-Place Concrete

1.04 SUBMITTALS

Information on the Contractor's proposed forming system shall be submitted in such detail as the Owner may require to assure himself that the intent of the Specifications can be complied with by the use of the proposed system. Except as otherwise specified, or accepted in writing by the Owner only forming systems by manufacturers with a minimum of five years' experience shall be considered.

1.05 ARRANGEMENT

Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

1.06 NOTIFICATION

Before placing concrete, and after placing reinforcing steel in forms, notify the Owner and Inspector. Make notification at least two working days in advance of placing concrete to permit arrangements for site visit.

1.07 INSPECTION

Prior to placing of any concrete, and after placement of reinforcing steel in the forms, Contractor shall notify the Owner so that proper inspection may be made. Such notification shall be made at least 24 hours in advance of placing concrete to permit proper arrangements to be made for inspection.

1.08 TOLERANCES

Variation from plumb in lines and surfaces of columns, walls, and arises shall not exceed 1/8" in 10 feet.

Variation in linear building lines from established position in plan and related position of columns, piers, or walls shall not exceed 1/2" in any bay of 20 feet.

1.09 REJECTION OF DEFECTIVE WORK DUE TO IMPROPER FORMS

Any movement or bellying of forms during construction or variations in excess of the tolerances specified will be considered just cause for the removal of such forms and, in addition, the concrete work so affected. Reconstruction of forms and new concrete (including disposal of rejected materials) shall be furnished at no additional cost to the Owner.

PART 2 - PRODUCTS

2.01 MATERIALS

Earth forms may be used for footings only where the soil is firm and stable and the concrete will not be exposed. Where earth forms are to be used, excavations shall be cut neat and accurate to size for placing of concrete directly against the excavation.

Boards for unexposed concrete, not otherwise scheduled or specified, shall be Douglas Fir, conforming to the "Standard Grading and Dressing Rules No. 16", most current edition, of the West Coast Lumber Inspection Bureau. Boards shall be S4S. Contractor at his option, may use plywood for forms in lieu of boards. Plywood, if used, shall be "B-B Plyform Class I Exterior" grade, conforming to U.S. Product Standards PS 1-83, 5/8" minimum thickness. Plywood used for exposed concrete shall be a high density overlay type especially manufactured for form work.

A. FORM TIES AND SPREADERS: Standard metal form clamp assembly, of type acting as spreaders and leaving no metal within 1" of concrete face. Inner tie rod shall be left in concrete when forms are removed. Submit samples and manufacturer's specifications to Owner for review and approval by the Owner before using. Wire ties or wood spreaders will not be permitted.

B. FORM COATING: Nongrain raising and nonstraining type that will not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface. Coatings containing mineral oils or other nondrying ingredients are not be permitted. Acceptable products include, but are not limited to the following:

Non-Crete Company; Nox-Crete Form Coating
Arcal Chemical Corp.; Arcal 80
Industrial Synthetics Co.; Synthex

PART 3 - EXECUTION

3.01 GENERAL

The engineering and construction of all formwork, shoring and bracing shall be carried out by and under the direction of the Contractor, who shall be responsible for the engineering, construction, maintenance, and safety of all formwork during the entire construction period.

The design of all concrete forms, falsework, and shoring shall be the responsibility of the Contractor and the design and installation of these items shall comply with all local, State, and Federal regulations.

The formwork shall be designed for the loads and lateral pressure outlined in Part 3, Section 102, of ACI 347.

3.02 FORMS AND ACCESSORIES

A. GENERAL: Forms shall be so constructed that the finished concrete will conform to the shapes, lines, grades, and dimensions indicated on the Drawings. It is intended that the surface of the concrete after stripping shall present a smooth, hard, and dense finish that will require a minimum amount of finishing. Sufficient number of forms shall be provided so that the work may be prosecuted rapidly and present a uniform appearance in form patterns and finish. Forms shall be clean and free from all dirt, debris, concrete, etc. and shall be coated with an acceptable form release oil if required, prior to use of reuse.

B. BUILT-UP PLYWOOD FORMS:

1. Built-up plywood forms may be substituted for a prefabricated forming system subject to the following minimum requirements: full sized (4 foot by 8 foot) plywood sheets must be used except where smaller pieces will cover an entire area.

2. Plywood sheets shall be 5-ply, 3/4 inch nominal, made with 100 percent waterproof adhesive, and the finish surface shall be coated or overlaid with

a surface which is impervious to water and the alkaline calcium and sodium hydroxide of cement.

3. Studding shall be not less than 2 inch by 4 inch lumber spaced at 16 inches or 24 inches on center.

   a. Closer spacing may be required depending upon the strength requirements of the forms, in order to prevent any bulging surfaces on the faces of finished concrete work.

   b. Studs shall be installed perpendicular to the grain of the exterior plys of the plywood sheets.

4. Wales shall be formed of double 2 inch by 4 inch lumber as a minimum.

5. Studding and wales shall contain no loose knots and shall be free of warps, cups, and bows.

6. The number of reuses of forms will depend upon the durability of the surface coating or overlay used, and the Contractor's ability to maintain the forms in a condition which will produce a flat, smooth, hard, dense finish on the concrete when stripped.

7. Alternate combination of plywood thickness and stud spacing may be submitted to the Owner for review and acceptance.

C. STEEL OR STEEL FRAMED FORMS:

1. Steel forms shall be rigidly constructed and adequately braced for minimum deflection of the finish surface. The finish surface shall be flat without bows, cups, or dents.

2. Steel framed plywood forms shall be rigidly constructed and braced with joints fitting closely and smoothly.

   a. Plywood paneling shall be 5-ply, 5/8 inch nominal or 3/4 inch nominal, made with 100 percent waterproof adhesive, and the finish surface shall be coated or overlaid with a surface which is impervious to water and the alkaline calcium and sodium hydroxide of cement.

   b. The number of reuses will depend upon the durability of the surface coating or overlay used.

3. Built-up plywood forms, as specified herein, may be used in conjunction with steel forms or steel framed plywood forms for special forming

conditions such as corbels and forming around items which will project through the forms.

D. INCIDENTALS:

1. Where not otherwise indicated on the Drawings, all external angles of walkways, slabs, walls, beams, columns, and openings shall have a 3/4 inch bevel formed by utilizing a true dimensioned wood or solid plastic chamfer strip and external angles of walkways, walls, and slabs at expansion, contraction, and construction joints shall be a 1/2 inch bevel formed by utilizing a true dimensioned wood or solid plastic chamfer strip.

   a. Reentrant angles may be left square.

   b. Level strips shall be installed at the top of all wall concrete placements to maintain a true line at all horizontal construction joints.

2. Keyways shall be constructed as indicated on the Drawings. Material for keyways shall be steel, plastic, or lumber treated with form coating, applied according to label directions.

3. Pipes, anchor bolts, steps, reglets, castings, and other inserts, as indicated on the Drawings or as required, shall be encased in the concrete. Dovetail anchors or ties shall be used in conjunction with the slots or inserts for the various materials as specified under their respective sections and as may be necessary for the required work.

4. All exposed corners shall be chamfered 3/4", unless shown otherwise on drawings. Provide molding in forms for all chamfering required.

E. BRACING AND ALIGNMENT OF FORMS:

1. It shall be the Contractor's responsibility to limit deviations in line and grade to tolerances which will permit proper installation of all structural embedded items or mechanical and electrical equipment and piping.

2. All formwork shall be securely braced, supported, tied down, or otherwise held in place to prevent any movement of formwork. Adequate provisions shall be made for uplift pressure, lateral bulging of forms, and deflection of forms for slabs and beams.

3. When a second lift is placed on hardened concrete, special precautions shall be taken in the form work at the top of the old lift and bottom of the new lift to prevent spreading, vertical or horizontal displacement of forms; and to prevent grout "bleeding" on finished concrete surfaces. Pipe stubs, anchor bolts, and other embedded items shall be set in the forms where required.

4. No concrete shall be placed until all forms have been thoroughly checked by the Contractor for alignment, level, strength, and to assure accurate location of all mechanical and electrical inserts or other embedded items. All cracks, openings, or offsets at joints in the formwork which are 1/16 inch or larger shall be closed by tightening the forms of by filling with an acceptable crack filler.

F. FORM TIES:

1. Form ties for the forming system selected shall be the cone-snap tie or flat bar type as manufactured by a recognized manufacturer of concrete forming equipment.

2. Forms shall be tied together at not less than 2 foot centers vertically and horizontally.

3. Wire ties or wood spreaders of any form shall not be used. Ties shall be of a type that will accurately tie, lock, and spread the forms.

4. Forms and ties shall be designed to withstand concrete pressures without building, spreading, or lifting of the forms.

5. The form tie shall be of such design that when the forms are removed, no metals shall be within 3/4 inch of any surface.

G. REMOVAL OF FORMS: Framing shall remain in place for the minimum time(s) indicated herein.

1. Vertical forms shall remain in place a minimum of 24 hours after the concrete is placed. If, after 24 hours, the concrete has sufficient strength and hardness to resist surface or other damage, the vertical forms may be removed.

2. Other forms supporting concrete and shoring shall remain in place as follows:

a. Sides of footings	24 hours minimum
b. Vertical sides of beams, girders, and similar members	48 hours minimum
c. Slabs, beams, and girders	Until concrete strength reaches the specified strength or until shoring is installed

d. Shoring for slabs, beams, and girders	Until concrete strength reaches the specified strength
e. Wall bracing	Until concrete strength of the beams and slabs laterally supporting the wall reaches the specified strength.

3. Forms shall not be removed from concrete which has been placed with outside ambient air temperature below 50 degrees F until the concrete has attained the specified strength as determined by test cylinders stored in the field under equivalent conditions as the concrete structure. No heavy loading on green concrete will be permitted. Green concrete shall be defined as concrete with less than the specified strength. Immediately after forms are removed, the surface of the concrete shall be carefully examined, and any irregularities in the surface shall be repaired and finished as specified hereinafter.

END OF SECTION 03110

SECTION 03210

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.01 SCOPE

The work includes the furnishing and installing of reinforcing steel for all cast-in-place concrete.

1.02 GENERAL

Contractor shall check project or contract architectural, structural, mechanical, and electrical drawings for anchors, inserts, conduits, sleeves, and any other items which are required to be cast in concrete, and shall make necessary provisions as required so that reinforcing steel will not interfere with the placement of such embedded items.

1.03 CODES AND STANDARDS

Except as modified by the requirements specified herein and/or the details on the drawings, all work included in this section shall conform to the applicable provisions of the following codes and standards:

1. "California Code of Regulations": 1997, Title 24, Chapter 19, Concrete.

2. Concrete Reinforcing Steel Institute (CRSI): "Recommended Practice for Placing Reinforcing Bars", latest edition.

3. American Concrete Institute (ACI): "Manual of Standard Practice for Detailing Reinforced Concrete Structures", ACI 315, latest edition.

4. American Society for Testing and Materials (ASTM): The specifications and standards hereinafter referred to, latest edition.

1.04 SUBMITTALS

Mill affidavits, stating the grades and physical and chemical properties of the reinforcing steel, and conformance with ASTM Specifications, shall be submitted to the Owner for review and approval by the Owner before delivery of the steel to the job site.

1.05 STORAGE

Reinforcing steel shall be transported to the building site, stored and covered in a manner which will insure that no damage shall occur to it from moisture, dirt, grease, or any other cause that might impair bond to concrete.

A sufficient supply of approved reinforcing steel shall be stored on the building site at all times to insure that there will be no delay of the work. Identification of steel shall be maintained after bundles are broken.

PART 2 - PRODUCTS

2.01 MATERIALS

A. REINFORCING BARS: New, deformed, billet steel bars conforming to ASTM A615-84a Grade 40 unless otherwise indicated. Deliver bars new and free from rust and mill scale in original bundles with mill tags intact.

B. WELDED WIRE FABRIC: New, welded steel wire fabric, conforming to ASTM A185-73. Gauge and center-to-center spacing shall be as noted on drawings.

C. ACCESSORIES: Reinforcement accessories, consisting of spacers, chairs, ties, and similar items shall be provided as required for spacing, assembling, and supporting reinforcement in place. All metal accessories shall be galvanized steel or approved plastic accessories, conforming to the applicable requirements of the CRSI Standards specified herein.

D. TIE WIRE: Tie wire for reinforcement shall be 16 gauge or heavier, where indicated or specified, black or galvanized steel wire, conforming to ASTM A82-79.

PART 3 - EXECUTION

3.01 FABRICATION

Fabrication of steel reinforcement shall be in accordance with the details shown on the drawings. Where specific details are not shown or noted, comply with the applicable requirements of the "Codes and Standards" hereinbefore specified.

Bars shall be accurately bent, cut, and placed as indicated on the drawings. Bars shall be bent cold; heating of bars will not be permitted. Bars shall not be bent or straightened in any manner that will injure the material.

3.02 PLACING

A. GENERAL: Place reinforcing steel as indicated and in accordance with the applicable requirements of referenced specified. Install reinforcement accurately and secure against movement, particularly under the weight of workmen and placement of concrete.

1. Clean reinforcement of loose rust and mill scale, earth, and other materials which may reduce or destroy bond with concrete.

B. REINFORCING SUPPORTS: Support reinforcing bars above earth and on forms by concrete blocks or other approved noncorrodible supports. Support legs of accessories in forms without embedding in form surface. Space chairs and accessories to conform with CRSI's "Recommended Practice for Placing Bar Supports". No wood will be permitted inside forms.

C. PLACING AND TYING: Set reinforcing in place, and rigidly and securely tie or wire with 16 gauge steel tie wire in the position indicated, or as directed. Point ends of wire away from forms.

D. SPACING: Minimum center to center distance between parallel bars shall be in accordance with the details on the drawings or, where not shown, the clear spacing shall be 2 times the bar diameter but in no case less than 1-1/2" nor less than 1-1/3 times the maximum size aggregate.

E. SPLICES: Laps of splices, where shown or noted on drawings, shall be adequate to transfer stress by bond. Wherever possible, splices of adjacent bars shall be staggered. Reinforcing bars marked continuous shall be spliced with a minimum lap of (40) bar diameters in masonry and (30) bar diameters in concrete.

F. DOWELS: Dowels shall be tied securely in place before concrete is deposited. In the event there are no bars in position to which dowels may be tied, No. 3 minimum shall be added to provide proper support and anchorage. Bending of dowels after placement of concrete will not be permitted.

G. CLEANING: Reinforcement, at time of pour, shall be free of all coatings that would impair bond to concrete.

3.03 INSPECTION

A. Contractor shall notify Owner at least 24 hours ahead of each concrete pour, and no concrete shall be placed until all reinforcing steel has been installed, inspected and approved by the Inspector.

B. The following reinforcing steel work will be considered defective and shall be removed and replaced at no additional cost to the Owner.

1. Bars with kinks or bends not shown on drawings.

2. Bars injured due to bending or straightening.

3. Bars heated for bending.

4. Reinforcement not placed in accordance with the drawings and/or specifications.

END OF SECTION 03210

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE

The work includes the furnishing and installing of cast-in-place concrete work as shown and noted on the drawings and specified herein.

Except as otherwise specified, concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, and water so proportioned and mixed as to produce a plastic, workable mixture in accordance with all requirements of these Specifications and suitable to the specific conditions of placement. The portions of materials shall be such as to secure the lowest water-cement ratio which is consistent with good workability, a plastic, cohesive mixture, and one which is within the specified slump range. The proportion of fine and coarse aggregate shall be such as not to produce harshness in placing nor honeycombing in the structures.

1.02 RELATED SECTIONS

A. SECTION 02200: Earthwork and Site Preparation

B. SECTION 03110: Concrete Formwork

C. SECTION 03210: Concrete Reinforcement

1.03 CODES AND STANDARDS

Except as modified by the requirements specified herein and/or the details on the drawings, all work included in this section shall conform to the applicable provisions of the following codes and standards:

1. Uniform Building Code, Latest Edition, Chapter 26, "Concrete".

2. American Concrete Institute (ACI): "Building Code Requirements for Reinforced Concrete", ACI 318-71.

3. American Society for Testing and Materials (ASTM); The specifications and standards hereinafter referred to, latest edition.

1.04 MIX DESIGNS

Designs of concrete mixes, including recommended amounts of admixture and water to be used in the mixes, shall be obtained by the Contractor from a recognized independent testing laboratory. Costs of obtaining the mix designs shall be paid for by the Contractor. Contractor shall be responsible for incorporating into the structure, concrete of the minimum strengths specified. The Contractor shall submit designs for each class of

concrete for the Owner's review. Concrete mix designs shall bear the signatures and seal of a California Registered Civil Engineer.

1.05 SUBMITTALS

Submit concrete mix designs, reinforcing steel, fibrous reinforcing, expansion joints, water stops and related product data to the Owner for review and approved per Section 01340.

Certified copies in triplicate of mill tests representative of each shipment of cement shall be furnished to the Owner for verification of compliance with these Specifications. Mill tests on cement shall include a report on alkali content.

1.06 CLASSES OF CONCRETE

Concrete shall be of five classes, herein referred to as Classes A, B, C, D, and CE which shall be as specified herein and which shall be used where specified or indicated on the Drawings. These classes of concrete shall have a minimum weight of 140 pounds per cubic foot. Class C concrete may be used for fill for unauthorized excavation, for thrust blocks and ground anchors for piping, for bedding of pipe, and where indicated on the Drawings. Class B concrete may be substituted for Class A concrete, if high-early strength concrete is desired by the Contractor, only in those areas specifically approved by the Owner and which do not require a sulfate resistant concrete. Class D concrete shall be used for precast concrete items and all structures used for wastewater applications. Class CE shall be used for electrical encasements. All other concrete, unless specified or otherwise indicated on the Drawings, shall be Class A concrete.

TABLE B

CONCRETE
WITHOUT AIR ENTRAINMENT

Class	Specified Compressive Strength f'c At 28-Days (psi)	Max. Net Water To Cement Ratio By Weight	Min. Cement Per Cubic Yard Of Concrete (Pounds)	Slump Range (Inches)
A	3,500	0.53	564	2 to 4**
B Type III Cement	3,500	0.53	564	2 to 4**
C	2,500	0.71	423	3 to 6
D	4,500	0.45	658	2 to 4
CE	2,500	0.71	564	3 to 6

**NOTE: Slump for slabs, decks, walks, and beams shall be not more than 3-1/2 inches. Concrete that is pumped shall meet all the requirements of these Specifications. Concrete with a slump outside the limits indicated in the Table B shall not be placed.

Classes A, C, and CE concrete shall be made with Type II low alkali cement. Class B concrete shall be made with Type III low alkali cement. Class D concrete shall be made with Type V low alkali cement for wastewater applications (wet wells, sewage manholes, etc.) and Type II low alkali cement for non-wastewater applications. Admixtures shall be as specified hereinafter.

The exact proportions of the mix, including amounts of admixture (if any) and water, shall be determined by the Testing Laboratory or Mill, based cement and aggregate submitted by the Contractor.

1.07 TOLERANCES

It is the intent that the finished concrete conforms to the shapes, lines, grades, and dimensions indicated on the Drawings. It shall be the responsibility of the Contractor to comply with the intent of these Specifications, but it is also recognized that there will be occasions when some deviation will occur or be required. It shall therefore be agreed that the maximum deviation from true line and grade shall not exceed the tolerances listed below at the time of acceptance of the project.

A. In general, all tolerances shall comply with AC1 117-81, paragraphs 2.0 through 2.2 and paragraphs 4.0 through 4.5, except as modified in the following. All slabs shall be uniformly sloped to drain when a slope is indicated. Slabs which are indicated to be level shall have a maximum deviation of 1/8 inch in 10 feet without any apparent changes in grade.

B. On circular tank walls, the Contractor may deviate from the finish line indicated on the Drawings by the use of forms with chord lengths not to exceed 2 feet.

C. All inserts shall be set to the tolerances required for the proper installation and operation of the equipment or systems to which the insert pertains. The following shall be considered maximum tolerances.

Item	Maximum Tolerance, Inches
Sleeves and inserts	plus 1/8 minus 1/8
Projected ends of anchor bolts	plus 1/4 minus 0.0
Anchor bolt setting	plus 1/16 minus 1/16

1.08 WATERTIGHTNESS OF CONCRETE WORK

A. GENERAL: It is the intent of this Specification to secure for every part of the Work concrete and grout of homogeneous structure, which when hardened will have the required strength, watertightness, and resistance to weathering.

B. SURFACE HAIRLINE CRACKS: It is recognized that some surface hairline cracks and crazing will develop in the concrete surfaces. Construction, contraction, and expansion joints have been positioned in structures, and curing methods specified, for the purpose of reducing the number and size of these expected cracks, due to the normal expansion and contraction expected from the specified concrete mixes. Class A, Class B and Class D concrete shall be watertight. Cracks which develop in walls or slabs shall be repaired. Cracks which show any signs of leakage shall be repaired until all leakage is stopped.

C. VISIBLE CRACKS: Visible cracks, other than hairline cracks and crazing, in the following areas shall be pressure grouted with low viscosity epoxy as specified herein as Epoxy Injection System: floors and walls of water bearing structures; walls and overhead slabs of passageways or occupied spaces, the outside of which are exposed to weather or may be washed down and are not specified to receive a separate waterproof membrane; slabs over water channels, wet wells, reservoirs, and other similar surfaces not specified to receive a separate waterproof membrane.

Walls or slabs, as above, that leak or sweat because of porosity or cracks too small for successful pressure grouting, shall be sealed on the water or weather side by coatings of a surface sealant system, as specified elsewhere herein.

Grouting or sealing as specified above shall be continued until the structure is watertight and shall remain watertight for not less than one year after final acceptance or date of final repair, whichever occurs later in time.

1.09 TESTING OF CONCRETE

A. GENERAL: During the progress of construction, the Owner will have tests made to determine whether the concrete, as being produced, complies with the requirements specified herein. These tests shall be made in accordance with ASTM C 31, ASTM C 39, and ASTM C 172. Test cylinders will be made and delivered to the laboratory by the Owner and the testing expense will be borne by the Owner.

Not less than three cylinder specimens, 6 inch diameter by 12 inch long, will be tested for each 50 cubic yards of each class of concrete with a minimum of three specimens for each class of concrete placed and not less than three specimens for each half day's placement. One cylinder will be broken at 7 days and two at 28 days.

The Contractor shall test the slump of concrete using a slump cone in accordance with the requirements of ASTM C 143. The Contractor shall

provide the test equipment. Concrete that does not meet the Specification requirements as to slump shall not be used but shall be removed from the job. The Contractor shall test the slump at the beginning of each placement, as often as necessary to keep the slump within the specified range, and when requested to do so by the Owner.

The Contractor shall make provisions for and furnish all concrete for the test specimens, and provide manual assistance to the Owner in preparing said specimens. The Contractor shall be responsible for the care of and providing curing conditions for the test specimens in accordance with ASTM C 31.

PART 2 - PRODUCTS

2.01 MATERIALS

A. PORTLAND CEMENT: ASTM C150-85, Type I or II. Type II cement shall meet the strength requirements of Type I cement. Use only one brand of cement on the project.

B. FINE AGGREGATE: ASTM C33-85, graded from 1/4" to fine.

C. COARSE AGGREGATE: ASTM C33-85, graded from 1/4" to maximum sizes specified.

D. ADMIXTURE: ASTM C-494-90, of a type that increases workability and reduces water demand, but will not increase shrinkage. Admixture shall be submitted to Owner for review and approval by the Owner. Admixtures shall be free of chlorides.

E. AIR ENTRAINING ADMIXTURE: All concrete shall contain 5 percent, plus or minus 1 percent, entrained air of evenly dispersed air bubbles at the time of placement. The air entraining agent shall conform to ASTM C 260. The air entraining agent shall be added to the batch in a portion of the mixing water. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

F. WATER: Clean and potable, free of impurities detrimental to concrete.

G. CURING-SEALER: Curing and sealing for floor shall be one of the following acrylate resin compounds or equal.

- AC Horn, Inc. "Horn Clear Seal 300"
- Sonneborn-Contech "Kure-N-Seal 0800"

H. EXPANSION JOINT FILLER: Premolded, of sizes and thicknesses shown on drawings, conforming to ASTM D1751-73.

I. EXPANSION JOINT SEALING COMPOUND: Joint sealant and backerod shall be a traffic grade polyurethane. Use submerged type sealant for water-carrying structures and related potentially west areas. Refer to Section 07900, Paragraph 2.1.3.

J. CLEAR SEALER HARDENER: Sonneborn "Lapidolith", Protex Industries "Lithoplate" or approved equal.

2.02 WATERSTOPS

A. GENERAL: Waterstops shall be installed in concrete joints where indicated on the Drawings and in all water bearing structures. Waterstop shall be rubber or polyvinyl chloride.

Waterstops in the walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings. All joints in water bearing structures shall have waterstops, whether indicated on the drawings or not. All waterstops shall be continuous. Waterstops shall be set accurately to the position and line indicated on the Drawings. Edges shall be held and securely fixed in position at intervals of not more than 12 inches so that they will not move during the placing of concrete. No nails shall be driven through waterstops in the vicinity of construction joints. Wires at not more than 12 inches on centers near the outer bulbs shall be used to tie the waterstops into position. Special clips may be used in lieu of wires, at the Contractor's option. Waterstops shall be terminated 3 inches from the top of finished surfaces of walls and slabs unless otherwise specified or indicated on the Drawings.

Waterstops shall be manufactured by Burke Concrete Accessories Inc.; Greenstreak Plastic Products Division of Western Textile Products Company, Kirkhill Rubber Company; Williams Products Inc.; or equal.

Ribbed type waterstops will not be allowed.

B. RUBBER WATERSTOPS: Unless otherwise specified or indicated on the Drawings, rubber waterstops shall be 6 inch flat dumbbell type, centered, at construction and contraction joints, and 9 inch wide dumbbell type with 1 inch diameter hollow center bulb, centered, at expansion joints. Rubber waterstop shall meet the following requirements:

		Test Method
Hardness – Shore A durometer	60 to 70	ASTM D 2240
Elongation – not less than	450 percent	ASTM D 412
Tensile strength – not less than	3,000 psi	ASTM D 412
300 percent modulus – not less than	900 psi	ASTM D 1456
Water absorption after two days at 158 degrees F	5 percent	ASTM D 471
Tensile strength after aging 48 hours in oxygen at 70 degrees C and 300 psi	80 percent of origin	ASTM D 572
Compression set, 22 hours at 158 degrees F	30 percent	
Specific Gravity	1.17 plus or Minus 0.03	ASTM D 395

The Contractor shall submit samples, prints, and complete physical property data covering the waterstop.

Rubber waterstop shall be manufactured to insure an integral cross section which will be dense, homogeneous, and free from porosity and other imperfections. Minor surface defects such as surface peel covering less than 1 square inch and surface cavities or bumps less than 1/4 inch in longest lateral dimension and less than 1/16 inch deep, will be acceptable.

All waterstops shall be installed so that all joints are watertight. All joints for rubber waterstops shall be made by the use of factory-made fittings and unions, some of which be special. Fittings and unions shall be cemented in place using clamps over the entire area of splice until the cement is bonded permanently. Welding of the waterstop without the use of factory-made unions and fittings, will not be permitted. Split type waterstop will not be permitted except where specifically indicated on the Drawings.

Cement shall be as recommended by the manufacturer of the waterstop, and field cementing or solvent welding shall be in accordance with the manufacturer's printed directions.

C. POLYVINYL CHLORIDE WATERSTOPS: Unless otherwise specified or indicated on the Drawings, polyvinyl chloride waterstop shall be 6 inch flat dumbbell type, centered, at construction and contraction joints, and 9 inch wide dumbbell type with a 1 inch diameter hollow center bulb centered at expansion joints. The waterstop shall be manufactured from virgin polyvinyl chloride plastic compound and shall not contain any scrap or reclaimed material.

The Contractor shall submit samples, prints, and complete physical property data covering the waterstop. The Contractor shall submit written certifications that all of the material supplied on this project meets or exceeds the physical property requirements of the current U.S. Army Corps of Engineers Specification No. CRD-C572 and shall submit laboratory test reports indicating that the average properties of all the materials and finished waterstops conform to the following:

2.03 SYNTHETIC SPONGE RUBBER FILLER

A. Synthetic sponge rubber filler shall be an expanded closed-cell sponge rubber backer rod manufactured from a synthetic polymer neoprene base; or a resilient closed-cell polyethylene foam backer rod. The synthetic sponge rubber filler shall have characteristics suitable for the application intended, including the following:

1. Necessary strength for supporting the sealing compound during application.

2. Sufficient resiliency to prevent significant load transfer across the joint.

3. Resistance to the environmental conditions of the installation.

4. No bonding to the sealing compound.

5. A cellular structure that shall prevent wicking or absorption of water.

6. Compatibility with other materials in the joint, and acceptance by the manufacturer of the sealing compound.

B. The size of the synthetic sponge rubber filler shall be 25 percent greater than the nominal joint width.

C. Acceptable products include No. 750.3 Ropax Rod Stock manufactured by the Presstite Division of Interchemical Corporation; Rubatex-Cord manufactured by the Rubatex Corporation; or approved equal.

D. Surface preparation and installation of the synthetic sponge rubber filler shall be as recommended by the manufacturer in published instructions. The synthetic sponge rubber filler shall not be stretched beyond its normal length during installation.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND METHODS

Concrete work, including detailing of reinforcing, shall be in accordance with the best standard practices and as set forth in the ACI Building Code, Manuals, and Recommended Practices.

All concrete materials shall be so delivered, stored, and handled as to prevent damage to the materials and the inclusion of foreign substances. Packaged materials shall be delivered and stored in original containers until ready for use. Material containers or materials showing evidence of water or other damage shall be rejected.

3.02 MIXING

Use ready-mixed concrete mixed and delivered in accordance with the requirements of ASTM C 94-84, and UBC Standard No. 26-13. In the event concrete is mixed at a central batching plant, arrange delivery so intervals between batches are kept at a minimum, and in any event not more than 30 minutes. No water shall be added during transit or at the Project site without the Inspector's approval. Place concrete within 90 minutes after cement has been mixed with aggregate or 45 minutes after addition of water and admixtures.

All concrete shall be ready-mixed concrete and shall be mixed and delivered in accordance with the requirements of "Specifications for Ready-Mixed Concrete", ASTM C94072, and U.B.C. Standard No. In the event concrete is mixed at a central batching plant, the delivery shall be arranged so that intervals between batches are kept at a minimum, and in any event not more than thirty (30) minutes. Trucks shall be in first-class condition and kept in constant rotation during delivery. No water shall be added during transit or at the job without specific approval of the Owner. Concrete shall be placed within 90 minutes after cement has been mixed.

3.03 CONVEYING AND PLACING CONCRETE

A. GENERAL: The Contractor shall submit a proposed sequence of placing concrete showing proposed beginning and ending of individual placements. After acceptance, this sequence shall be adhered to except when specific changes are requested by the Contractor and accepted by the Owner.

B. NOTIFICATION: Notify the Owner's Inspector at least two working days in advance of the placing of any concrete.

C. Obtain approval of soil bottoms for footings and slabs from the Soils Engineer before placing concrete.

D. FORMS: Before placing concrete, forms shall be thoroughly inspected. All wood chips, dirt, etc., shall be removed, all temporary bracing and cleats taken out, all openings for pipes, etc., properly boxed, all forms properly secured in their correct position and made tight, all reinforcement, anchors, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcement and which is set and dry, shall be cleaned off and the forms and steel washed off before proceeding.

E. Sprinkle semiporous subgrades with water sufficiently to eliminate suction.

F. HANDLING AND DEPOSITING:

1. Complete concreting, once started, in continuous operations until the section of approved size and shape is completed.

2. Handle concrete as rapidly as practical from the mixer to place of final deposit by methods which prevent the separation or loss of ingredients. Deposit in its final position to avoid rehandling or flowing.

3. Do not drop concrete freely where reinforcing will cause segregation, nor more than 4 feet. Deposit concrete to maintain a plastic surface approximately horizontal.

4. Do not deposit concrete that has partially hardened.

G. VIBRATING AND COMPACTING:

1. Consolidate and compact concrete by suitable means during the operation of placing and depositing, and thoroughly work around reinforcement, embedded items, and into the corners of the forms. Spade concrete against forms. Use internal vibrators, and keep out of contact with reinforcement and wood forms. Do not use vibrators in a manner that forces mortar between individual form members.

2. Vibrate close to the forms but do not continue at one spot to the extent that large areas of grout are formed or heavier aggregates are caused to settle. Take care not to disturb concrete which has taken its initial set.

H. TEMPERATURE REQUIREMENTS: Maximum placing temperature of concrete, when deposited, shall be 80 degrees F. If the weather causes the placing temperature to exceed 80 degrees F, cool the mix by wetting

aggregate or other appropriate methods specified in ACI 305-77, Hot Weather Concreting; a copy of which shall be kept at the job site at all times.

3.04 PATCHING

Immediately after stripping forms, patch minor defects, form tie holes, honeycombed areas, before concrete is thoroughly dry. Remove ledges and bulges. Repair gravel pockets by cutting out to solid surface, form key, and thoroughly wet before placing patching mortar. Use patching mortar consisting of one part cement to two parts fine sand; compact into place and neatly finish to match surface. Grind or fill surfaces to produce level, true planes.

3.05 CONCRETE SLAB FINISHES (AT GRADE OR ROOF)

A. STEEL TROWEL FINISH: Screed, wood float, and steel trowel surfaces. Provide a smooth, hard, dense, impervious surface, free of defects. Finishers shall work from knee boards laid flat upon the surface. Mechanical troweling machines may be used if the desired finish and level tolerances can be obtained by their use.

B. After concrete has been troweled and joints have been formed, use a soft bristled broom to provide a light, uniformly straight scored surface at right angles to the general flow of traffic.

C. SLAB LEVELS: Finish surfaces true to 1/8 inch in 10 feet on a straight-edge in any direction with maximum high and low variance occurring in not less than 20 feet and with 1/16 inch maximum tolerance in any one running foot. Take care to finish troweling around the edges of the slabs so finish surface edges will be at same elevations as the rest of the top surface of the slab. Use temporary screeds set level at the proper elevations.

D. MARK-OFF LINES: Form mark-off lines with curved edging tool, neat and true to line, uniform throughout. Conform to markings indicated.

E. WEAKENED PLANE JOINTS: Provide saw cut joints to the indicated depth after the surface has been finished. Sawed joints shall be completed within 4 to 12 hours after concrete placement. Protect joints from intrusion of foreign matter.

3.06 CURING AND SEALING

A. Protect concrete from injurious action of the elements and defacement of any nature during construction operations.

B. Keep concrete in a thoroughly moist condition from the time it is placed until it has cured for at least 7 days. Keep all forms sufficiently wet to prevent drying out of the concrete. Allow no slabs to become dry at any time until curing operations are complete.

C. Cure interior floor slabs with curing-sealing compound. Apply by method and at rates recommended by manufacturer.

1. Just prior to completion of project, apply a second coat of curing-sealer to entire floor slab surface, at a rate recommended by manufacturer.

3.07 EXPANSION JOINTS

Provide premolded expansion joints to full depth of slabs, where indicated on the drawings. Install with top edge 1/2" below the surface and tool adjacent concrete edges to a 1/8" radius. Use steel pins to hold material in place during placing and floating of concrete. After a minimum of 28 days after slabs have been placed and finished, fill tops of expansion joints with sealer to 1/8" below surface of slabs. No traffic shall be permitted to travel over sealed joints until sealer is thoroughly dry.

3.08 WATER STOPS

Provide water stops for all potentially submerged construction joints in structures. Install per manufacturer’s recommendations.

3.09 DEFECTIVE WORK

Defective concrete work shall be removed and replaced at Contractor's expense.

END OF SECTION 03300

SECTION 03480

PRECAST CONCRETE VAULTS AND MANHOLES

PART 1 - GENERAL

1.01 DESCRIPTION

This section covers the requirements for furnishing and installing precast vaults and manholes as indicated on the Contract Drawings. Under these specifications, a company regularly engaged in the manufacturing of precast vaults and manholes, as approved by the Owner, shall be required to furnish, deliver and properly set in place the specified precast concrete products.

1.02 RELATED SECTIONS

A. EARTHWORK AND SITE PREPARATION: Section 02200.

B. CAST-IN-PLACE CONCRETE: Section 03300

C. EPOXY COATING FOR CONCRETE WASTEWATER STRUCTURES: Section 09872

1.03 MANUFACTURER'S WARRANTY

The precast vault/manhole manufacturer shall guarantee all materials and workmanship of items furnished under these specifications shall be free from defects for a period of one year after final completion and acceptance of the contract work. All defective materials or workmanship found to be deficient with respect to any provisions of these specifications or referenced standards shall be repaired or replaced as approved by Owner, at no additional cost to the Owner. Submit, for the Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to and not a limitation of, other rights the Owner may have under the Contract Documents.

1.04 REFERENCE STANDARDS

A. GENERAL: Except as modified or supplemented herein, all precast concrete vaults and manholes shall conform to the applicable requirements of the ASTM and ACI Standards.

B. INDUSTRY STANDARDS:

1. Reference Specifications and Standards: Contractor shall comply with the recommendations of the Precast Concrete Institute (PCI), unless otherwise indicated in this Section.

2. Concrete Reinforcing Steel Institute, "Manual of Standard Practice".

1.05 SUBMITTALS

A. GENERAL: Submit shop drawings, including related details and data in accordance with the General Conditions.

B. CALCULATIONS: Submit design calculations and complete drawings signed and stamped by a Civil or Structural Engineer registered in the State of California.

C. JOINT SEALANTS: Submit joint sealing compound for watertight joints.

D. COATING: Submit per Section 09872.

E. CONCRETE: Submit concrete mix design.

F. INSTALLATION PROCEDURES: Submit manufacturer's recommended installation procedures.

G. COVERS AND HATCHES: Submit covers and hatches as indicated on the Contract Drawings.

H. CERTIFICATION: A statement shall be submitted giving the qualifications of the precast concrete fabricator, and evidence that the manufacturer is PCI certified.

1.06 PLANT REQUIREMENTS AND QUALITY ASSURANCE

A. GENERAL: All precast concrete vault and manhole sections, including top slab and base slab (if applicable), shall be manufactured in a plant especially designed for that purpose. All units shall conform to the design shown on the Contract Drawings, and all work shall be conducted under strict controlled supervision.

B. PLANT INSPECTION: Plant manufacturer shall provide certification that all units conform to the applicable requirements, provisions and tolerances set forth in the applicable ASTM Standards and the provisions described herein. Owner reserves the right to have its Engineer or Engineer's

representative present prior to and during the concrete pour for the precast products. Contractor shall notify the Owner two (2) working days in advance of concrete pour for all precast products to be furnished under these Contract Documents.

1.07 DESIGN LOADS

A. GENERAL: Design loads shall consist of dead load, live load, impact, and in addition, loads due to water table, and any other loads which may be imposed on the structure.

B. WATER TABLE: For purposes of design, the water table shall be assumed at a level of four (4) feet below the top of the precast vault or manhole.

C. LIVE LOADS: Live loads shall be for H-20 and/or H-20-S16 per AASHTO Standard Specifications for highway bridges with revisions. Design wheel load shall be 16 kips. The live load shall be that loading which produces the maximum shears and bending moments in the structure. No live loads shall be considered when analyzing the vault or manhole for uplift caused by the specified water table level.

D. EARTH LOADS: Soil weight, allowable bearing pressure, active soil pressure and passive soil pressure shall be in accordance with the soils report. If no soils report is available, use Uniform Building Code values.

1.08 DELIVERY, STORAGE AND HANDLING

A. LIFTING AND SUPPORTING: Precast units shall be lifted and supported from design incorporated support points based on design calculations and provided with strong backs and other devices as required. Lifting equipment shall be capable of handling units during manufacture, storage, transportation, erection, and fastening.

B. BLOCKING AND SUPPORTS:

Blocking and supports, lateral restraints and protective materials during transport and storage shall be clean, nonstaining, causing no harm to exposed surfaces. Lateral restraints shall be provided to prevent undesirable horizontal movement. Edges and exposed faces of units shall be protected to prevent straining, chipping, or spalling of concrete.

C. STORAGE: Precast units shall be stored off the ground in a manner to prevent warpage and shall be protected from weather, marring, and overload.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Approved manufacturer's are:

1. Inland Concrete Enterprises, Inc.

2. Jensen Precast

2.02 MATERIALS

A. CONCRETE: Concrete shall be 4,500 psi Class D in accordance with Section 03300. Cement shall be low alkali. Use Type V cement for wastewater applications and Type II cement for non-wastewater applications.

B. REINFORCING STEEL: All reinforcing steel shall be intermediate or hard grade billet steel conforming to ASTM A-615/A-706. Bars other than 1/4" round, or smaller, shall be deformed in accordance with ASTM A305.

C. COVERS AND HATCHES: Provide traffic rated or parkway rated spring-assisted, hinged covers and hatches as indicated on the Contract Drawings.

D. COATING: For wastewater applications, field applied coating shall be in accordance with Section 09872 (Epoxy Coating for Concrete Wastewater Structures).

2.03 FORMS

A. GENERAL: Forms shall be manufacturer's standard forms with smooth, hard, dense, and rigid casting surface; without bow and warpage, oil canning, or other imperfections.

B. FORM RELEASE AGENT: Form release agent shall be manufacturer's standard release agent, nonstaining, nonpetroleum based and shall be compatible with concrete surface sealer.

2.04 ACCESSORIES

Accessories shall be as indicated on the Contract Drawings. Plates, angles, anchors, and studs shall comply with ASTM A 666, Type 316L stainless steel.

2.05 FABRICATION

Precast concrete units shall be fabricated in accordance with ACI 318 and PCI MNL-116. Plant records and quality control program shall be maintained during production of precast units.

PART 3 – EXECUTION

3.01 HANDLING AND ERECTION

A. GENERAL: Before erecting, all relevant project site conditions shall be checked insofar as they affect the installation of precast elements.

Elements shall be erected in accordance with the referenced standards, drawings, Specifications, and Owner approved submittals, using competent craftspersons under the continuous supervision of the fabricator. Elements shall be accurately set in the positions assigned to them on the reviewed installation or erection drawings and securely anchored in final positions. All joints shall be sealed in strict conformity with detail drawings.

B. WORKMANSHIP: All field setting and installation shall be performed in a neat and workmanlike manner per the manufacturer's recommendations. Defective workmanship and/or materials shall be subject to rejection.

All cracked, damaged, or otherwise defective precast elements, not feasible to repair, shall be replaced until acceptable to the Owner without additional cost to the Owner.

C. JOINTS: Precast sections and base slab shall be joined with an approved joint seal compound for a watertight joint.

1. Precast sections below the specified potential water table shall be securely fastened and restrained to prevent sections from pulling apart.

D. CAST-IN-PLACE CONCRETE BASES: Unless otherwise approved by Owner, cast-in-place concrete bases shall cure a minimum of seven (7) days prior to setting of the precast vault or manhole sections.

E. PRECAST CONCRETE SECTIONS: Unless otherwise approved by the Owner, all precast sections below the top 18" of the structure shall be comprised of section heights equal to, or greater than, 30 inches. The top 18" of the structures shall contain grade rings or sections 6 inches to 12 inches in height.

3.02 WATERPROOFING

All buried exterior surfaces of concrete walls, including vaults and manholes, shall be protected from moisture with below-grade waterproofing system.

3.03 TOLERANCES

Tolerances shall be in accordance with requirements of PCI MNL-117 and as follows:

A. VARIATION FROM PLANE OF LOCATION: 1/4-inch in 10 feet maximum.

B. OFFSET FROM TRUE ALIGNMENT BETWEEN TWO CONNECTING MEMBERS: 1/4-inch maximum.

END OF SECTION 03480

DIVISION 5

METALS

DIVISION 5
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SECTION 05035
METALLIC COATINGS - ZINC

PART 1 - GENERAL

1.01 All structural steel plates, shapes, bars and fabricated assemblies required to be galvanized shall, after the steel has been thoroughly cleaned of rust and scale, be galvanized in accordance with the "Specification for Zinc (Hot-Galvanized) Coating on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars and Strip" (ASTM A123). Any galvanized part that becomes warped during the galvanizing operation shall be straightened.

1.02 Bolts, anchor bolts, nuts and similar threaded fasteners, after being properly cleaned, shall be galvanized in accordance with the "Specifications for Zinc Coating (Hot-Dip) on Iron and Steel Hardware" (ASTM A153).

PART 2 - MATERIALS

2.01 Material composition and application rates shall be as specified in the appropriate ASTM Standard.

PART 3 - EXECUTION

3.01 Field repairs to galvanizing shall be made using "Galvinox", "Galvo-Weld," or approved equal.

END OF SECTION 05035

SECTION 05120
STRUCTURAL STEEL

PART 1 - GENERAL

1.01 SUMMARY

This Section includes labor and materials which are required for the completion of structural steel construction as indicated and specified. The Conditions of the Contract and Division 1 apply to this Section as fully as if repeated herein.

1.02 REFERENCES

The editions of specifications and standards referenced herein, published by the following organizations, apply to the construction only to the extent specified by the reference.

American Institute of Steel Construction (AISC).
American Society for Testing and Materials (ASTM).
American Welding Society (AWS).
Steel Structures Painting Council (SSPC).
Research Council on Riveted and Bolted Joints (RCRBJ).

1.03 SUBMITTALS

A. SHOP DRAWINGS: Submit shop and erection drawings for review. Review of drawings will cover only the general scheme, design, and character of the details, but not the checking of dimensions nor will such review relieve the Contractor from responsibility for executing the construction in accordance with the Contract Documents.

1. Field Measurements: Before starting construction or proceeding with shop and erection drawings, verify measurements, lines, grades, elevations, locations and details of existing field conditions and be responsible for correctness, conformity, accuracy and execution of structural steel construction to conform to actual conditions.
2. Detailing: Detail in conformance with the AISC Manual "Structural Steel Detailing", except where otherwise indicated.
3. Field Connections: Clearly show field connections on the erection drawings with complete details as required so that the connections can be made without reference to the design drawings.
4. Provide setting drawings, templates, and directions for installation of anchor bolt and other anchorages to be installed under other sections.

B. PRODUCT DATA:

1. Submit manufacturer's certification for bolts, nuts, washers, filler material for welding, primer and nonshrink grout.

2. Submit mill test certificates for mill order steel which can be identified readily by means of heat or melt numbers marked at the mill.

1.04 QUALITY ASSURANCE

A. QUALIFICATION OF WELDING: Quality welding procedures and welding operators in accordance with AWS D1.1-83. Provide certifications that welders to be employed have satisfactorily passed AWS qualification tests. If recertification of welders is required, retesting will be the Contractor's responsibility.

B. REGULATORY REQUIREMENTS: Except as modified by the requirements indicated or specified herein, structural steel construction shall conform to the Uniform Building Code (UBC), Chapter 27 "Steel".

1.05 DELIVERY, STORAGE AND HANDLING

Deliver material in time to insure uninterrupted progress of the construction. Store materials in a manner to preclude damage and permit ready access for inspection and identification of each shipment. Store steel materials, either plain or fabricated, above the ground upon platforms, pallets, skids, or other supports. Keep materials free from dirt, grease, and other foreign matter, and protect from corrosion. Material showing evidence of damage will be rejected; immediately remove from the site.

PART 2 - PRODUCTS

2.01 GENERAL

Use only new and undamaged materials. Steel, which in the opinion of the Engineer is badly corroded or physically damaged, shall not be incorporated in the construction.

2.02 MATERIALS

A. STRUCTURAL STEEL, SHAPES, BARS AND PLATES: ASTM A 36-84a.

B. STRUCTURAL TUBES: ASTM A 500-84, Grade B or ASTM A 501-84.

C. STRUCTURAL PIPE MEMBERS: ASTM A 53-86, Type E or S, Grade B, with maximum sulfur content of 0.05 percent.

D. HIGH STRENGTH BOLTS: ASTM A 325-86a.

E. COMMON BOLTS AND NUTS: ASTM A 307-86a. Provide either hexagonal or square heads and nuts except use only hexagonal units for exposed connections.

F. FILLER METAL FOR WELDING: Meet the requirements of AWS D1.1-83. Electrodes shall be as recommended by their manufacturers for the position and other conditions of actual use. Electrodes shall be E70 series.

G. ANCHOR BOLTS, PINS AND RODS: ASTM A 307-86a, A 36-84a, or A 283-85, Grade D.

H. PRIMER: Fed. Spec. TT-P-645B.

I. GALVANIZING: ASTM A 123-84.

J. GALVANIZING REPAIR COMPOUND: High zinc dust content galvanizing repair paint conforming to Mil. Spec DOD-P-21035A or hot applied zinc rich material. Acceptable products include, but are not limited to, the following:

American Solder & Flux; Drygalv
Kenco Div.; Galvicon
Metalloy Products Co.; Galvalloy

K. METALLIC, NONSHRINK GROUT: For grout in concealed locations use premixed factory packaged, ferrous aggregate, grouting compound meeting the requirements of Corps of Engineers Specifications CRD-C-588-79. Acceptable products include, but are not limited to, the following:

Gifford-Hill & Co., Inc.; Supreme Plus
Master Builders; Embeco 636
Sonneborn Building Products; Ferrolith G-DS

L. NONMETALLIC, NONSHRINK GROUT: For grout in exposed to view locations, use premixed, nonmetallic, non-corrosive, non-staining grouting compound containing silica sands, portland cement, shrinkage compensating agents and water reducing agents, meeting the requirements of Corps of Engineers Specification CRD-C-621-81. Acceptable products include, but are not limited to, the following:

Gifford Hill & Co., Inc., Supreme
Master Builders; Masterflow 713
The Upco Company; Upcon Nonshrink

2.03 FABRICATION

A. GENERAL: Fabricate and assemble materials in the shop to the greatest extent possible. Shearing, flame cutting, and chipping shall be done carefully and accurately. Coordinate connection details to concrete. Verify lines, levels, and dimensions, where possible, just before

commencing fabrication of connection details. Correct construction that does not fit. Schedule and coordinate construction under this Section with that specified elsewhere. When not otherwise indicated or specified, comply with applicable requirements of AISC "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings".

B. EXPOSED STEEL WORK: Where steel surfaces are exposed to view in the finished construction, use only materials which are smooth and free of surface blemishes, including pitting, seam marks, roller marks, rolled trade names and roughness. Remove such blemishes by grinding or by welding and grinding, before cleaning, treating and application of surface finishes.

C. CONNECTIONS: Bolt or weld shop connections as indicated. One sided or other types of eccentric connections will not be permitted unless shown in detail on the shop drawings.
1. Make welded connections in accordance with AWS D1.1-83. Assemble and weld built-up sections by methods which will produce true alignment of axes without warp.
2. Grind and dress smooth, welds exposed to view in the finished construction, so that the shape and profile of the item welded is preserved.

D. JOINT: Compression joints depending upon contact bearing shall have bearing surfaces truly milled perpendicular to their axis. Cut or dress other joints straight and true.

E. HOLES: Cut, drill, or punch holes at right angles to the surface of the metal. Do not enlarge holes by burning, however holes may be enlarged by careful reaming. Holes in base or bearing plates shall be drilled. Holes shall be provided in members to permit connecting the construction of other trades.

F. MARKING: Mark members for erection in accordance with shop drawings. Members weighing over 4 tons shall have the weight so marked on the member. Long members shall be loaded onto the trucks and so marked.

2.04 SHOP PAINTING

A. GENERAL: Shop paint structural steel except galvanized members or those members or portions of members to be embedded in concrete or mortar. On embedded steel which is partially exposed, paint the exposed portion and the initial 2 inches of embedded areas only. Do not paint surfaces to be welded or high strength bolted with friction-type connections. Do not paint surfaces which are scheduled to receive sprayed-on fireproofing.

B. SURFACE PREPARATION: After inspection and before shipping, clean steelwork to be painted. Remove loose rust, loose mill scale and spatter, slag or flux deposits using power tool cleaning in accordance with SSPC SP-3.

C. PAINTING: Immediately after surface preparation, apply shop primer in accordance with manufacturer's instructions and at a rate to provide a dry film thickness of not less than 1.5 mils. Use painting methods which result in full coverage of joints, corners, edges and exposed surfaces.

2.05 GALVANIZING

A. GENERAL: All steel and ferrous metal items located on the exterior of the building, or otherwise specifically indicated to be galvanized, shall be galvanized by the hot-dip process, meeting the requirements of ASTM A 123-84. All required hot-dip galvanizing shall be done after fabrication, in the largest sections possible. Items too large for available dip tanks shall be sprayed, by approved methods, with molten zinc to coating thickness of 0.003 inch to 0.004 inch.

B. COATING WEIGHT: Weight of the zinc coating per square foot of actual surface shall average not less than 2.0 ounces and no individual specimen shall show less than 1.8 ounces.

C. REPAIR OF COATING: Restore shop galvanized metal necessitating field soldering or welding which in any manner removes original galvanizing, by using galvanizing repair compound in accordance with the manufacturer's instructions.

PART 3 - EXECUTION

3.01 PREPARATION

A. FIELD MEASUREMENTS AND TEMPLATES: Secure field measurements required for proper and adequate fabrication and installation. Furnish templates for exact location of items to be embedded in concrete and setting instructions required for installation.

B. TEMPORARY SHORING AND BRACING: Design and provide temporary shoring and bracing members with connections of sufficient strength to bear imposed loads. Remove temporary members and connections when permanent members are in place and final connections are made. Provide temporary guy lines to achieve proper alignment of structure as erection proceeds.

3.02 ERECTION

A. CONNECTIONS: Bolt field connections except where welding is indicated. Perform welding as specified for shop welding. Provide high strength bolted connections for principle bolted connections where indicated. Provide common bolted connections for secondary connections and other bolted connections not indicated otherwise. Install high-strength bolts in accordance with AISC/RCRBSJ "Specifications for Structural Joints Using ASTM A325 or A490 Bolts".

B. CAMBER: Inspect beams and girders in the shop for camber and align so that they are fabricated and erected with their camber turned upwards. Camber shall not exceed the requirements of the governing documents unless approved by the Engineer.

C. On exposed construction, remove erection bolts, temporary welds, run-off plates and backing strips. Fill holes from erection bolts with plug welds and grind smooth.

3.03 AS ERECTED DRAWINGS

After all steel has been erected, correct or revise the shop drawings and erection diagrams to correspond with the changes made in the field.

END OF SECTION 05120

SECTION 05990
MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SUMMARY
This Section includes the furnishing and installing of all miscellaneous metal work and related connections complete as indicated and as specified. The Conditions of the Contract and Division 1 apply to this Section as fully as if repeated herein.

1.02 REFERENCES
The editions referenced herein of Federal Specifications (Fed Spec.) and of the other standards and specifications published by the following organizations, apply to the Work only to the extent specified by the reference.

Aluminum Association (AA).
American National Standards Institute (ANSI).
American Institute of Steel Construction (AISC).
American Society for Testing and Materials (ASTM).
American Welding Society (AWS).
National Association of Architectural Metal Manufacturer's (NAAMM).

1.03 SUBMITTALS

A. Submittal procedures and quantities are specified in Section 01340.

B. SHOP DRAWINGS:
1. Submit fully detailed shop drawings of miscellaneous metal work giving sizes; details of fabricating and construction; methods of assembly and bracing; and locations of hardware, anchors, and all accessories.
2. Include shop and erection details, including cuts, copes, connections, holes, bolts and welds. Indicate welds, both shop and field, by standard welding symbols in AWS D1.1-83. Show the size, length and type of each weld. All materials to be brazed or soldered shall have connections indicated by symbols which are industry standards.
3. Contractor shall be responsible for all fabrication and for correct fitting of metal members shown on shop drawings.

1.04 DELIVERY, STORAGE AND HANDLING
Deliver material in time to insure uninterrupted progress of the work. Store materials in a manner to preclude damage and permit ready access for inspection and identification of each shipment. Store steel materials, either plain or fabricated, above the ground upon platforms, pallets, skids, or other supports. Keep materials free from dirt, grease, and

other foreign matter, and protect from corrosion. Material showing evidence of damage will be rejected; immediately remove rejected materials from the work.

1.05 FIELD MEASUREMENTS

Secure all field measurements required for proper and adequate fabrication and installation of the work. Furnish templates for exact location of items to be embedded in concrete and masonry and setting instructions required for all installation work.

PART 2 - PRODUCTS

2.01 MATERIALS

A. STEEL, ROLLED SHAPES, BARS AND PLATES: Standard structural sections, ASTM A-36-84a.

B. ANCHORS, BOLTS, AND FASTENINGS: ASTM A 307-86a, Grade A and ASTM A 563-84.

C. ELECTRODES: Meet the requirements of AWS A5.1-81 or A5.5-81 E60XX or E70XX.

D. GRATING: Cast iron grating with angle frame, 8 inches wide. Model No. A2422 as manufactured by Alhambra Foundry Company, or equal.

E. ALUMINUM GRATING: Irving "X-Bar" grating, Type AA standard bearing bar spacing as manufactured by IKG Industries Division of Harsco Corporation, or equal. Sizes shall be as shown on Sheet M-7, Detail B of Drawings.

F. DIAMOND PLATE: Diamond plate shall be 5/16 inch thick steel plate meeting the requirements of Fed. Spec. QQ-F-461C, Class I, pattern to be selected from manufacturers standard patterns.

G. PIPE SLEEVES: Pipe sleeves through concrete walls and footings shall be standard weight, wrought iron, mild steel, or cast iron sleeves with not less than 1/2 inch space all around between the sleeve and pipe.

H. SHOP PRIMER: Federal Specification TT-P-645 (zinc chromate).

I. GALVANIZING: Zinc coating meeting the requirements of ASTM A 123-84. Zinc coating for threaded products shall meet the requirements of ASTM A 153-82.

J. GALVANIZING REPAIR COMPOUND: High zinc dust content galvanizing repair paint meeting the requirements of Mil. Spec DOD-P-

21035A or hot applied zinc rich material. Acceptable products include, but are not limited to, the following:

American Solder & Flux; Drygalv
Kenco Div.; Galvicon
Metalloy Products Co.; Galvaloy

2.02 FABRICATION

Fabricate and assemble materials in the shop to the greatest extent possible. Perform shearing, flame cutting, and chipping carefully and accurately. Coordinate all connection details to concrete or masonry. Verify all lines, levels, and dimensions, where possible, just before commencing fabrication of connection details. Correct work that does not fit. Schedule and coordinate work under this Section with that specified elsewhere in order to produce a workmanlike installation. When not otherwise indicated or specified, comply with applicable requirements of AISC "Specifications for Design, Fabrication and Erection of Structural Steel for Buildings". Finish surfaces of exposed members smooth and free of markings, burrs, or other defects.

Bolt, braze or weld connections as indicated. One-sided or other types of eccentric connections will not be permitted unless indicated, and shown in detail on the shop drawings.

Cut, drill, or punch holes at right angles to the surface of the metal; do not enlarge by burning. Drill holes in base or bearing plates. Provide holes in members to permit connecting the work of other trades.

2.03 LADDERS AND PLATFORM

A. GENERAL: Construct platform to conform to sizes and arrangements indicated; join pieces together by welding unless otherwise indicated. Provide complete assemblies including steel shapes, struts, clips, brackets, bearing plates, threaded rods, and other components necessary for the support of ladders and platforms and as required to anchor the ladders and the supporting structure.

B. PLATFORM FLOOR: Fabricate of galvanized steel diamond plate. Reinforced as required to support minimum 100 pounds per square foot live load.

C. Weld all connections in accordance with AWS D1.1-83. Provide continuous welds, ground smooth where exposed.

D. FIXED LADDERS: Model 520-TU, heavy duty tubular, alloy 6063-T6 aluminum ladder as manufactured by O'Keeffe's, Inc., or equal. Provide walk-through rail extension model WRE where specified by contract documents.

2.04 ALUMINUM GUARDRAILS
Series C4800 manufactured by Crane Veyor Corp., or equal.

2.05. MISCELLANEOUS ROLLED STEEL PLATES AND SHAPES
Provide for platform framing, including toe board; mechanical equipment supports and other locations indicated or required to complete the work.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS
Steel and miscellaneous metal work shall conform with the applicable requirements of the referenced "Codes and Standards". Details indicated are typical, similar details apply to similar conditions. Check drawings for dimensions, elevation, size, and locations of installations. Supply miscellaneous metal items in ample time for incorporation in the work. Include reinforcing angels, plates, straps, brackets, hangers, clips, lugs, holes, sleeves, shims, other hardware as indicated or required for erection of steel and miscellaneous metal work and as required to complete the work as indicated.

3.02 WELDED CONNECTIONS
All welders shall be certified qualified welders. All welders welding light gage metal shall be qualified for light gage metal welding.

Welded connections shall be made in accordance with AWS D1.1-83. All welding shall be done in the shop unless otherwise indicated or specified.

All welds and other connections exposed in the finished work shall be ground and dressed smooth and so that the shape and profile of the item welded is preserved.

3.03 INSTALLATION

A. Install miscellaneous metal items as rapidly as the progress of other work will permit. Make splices and field connections with bolts, except where welding or brazing is indicated or approved on the shop drawings. Install fasteners as specified herein.

B. Set metal work accurately at the established lines and levels. Install work in strict accordance with approved drawings and actual conditions, true and horizontal or perpendicular as the case may be, level and square with angles and edges parallel with related lines of the building.

C. Anchor bolts, anchors, blockouts and sleeves shall be properly located and built into connecting work. Bolts and anchors shall be preset by the use of templates or such other methods as may be required to locate the anchors and anchor bolts accurately.

D. After assembly, the various members forming parts of a completed frame shall be aligned and adjusted accurately before being fastened. Tolerances shall conform to the applicable requirements of AISC "Code of Standard Practice". Contact shall be cleaned before the members are assembled. Poor matching of holes shall be corrected by drilling to the next larger size.

E. GUARDRAILS: Install railings at concrete floor and curbs by using a grout pocket incorporating a removable post socket #C4330 by C-V Pipe Rail or equal. Railings at steel framed platforms shall be side mounted using #C4332-6 mounts by C-V Pipe Rail or equal.

F. Install ladders in accordance with manufacturer's instructions.

G. WALL SUPPORTED ITEMS: Attach wall hung items by expansion anchors in masonry walls.

3.04 DISSIMILAR MATERIALS

Where dissimilar metals are in contact, or where aluminum is in contact with concrete or masonry, protect the surfaces with a coat of bituminous paint or a coat of zinc chromate primer.

3.05 GALVANIZED FINISH

Touch up all damaged galvanized finish due to installation, welding, threading or other work with treatment specified herein.

END OF SECTION 05990

DIVISION 9

FINISHES

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SECTION 09871

PAINTING AND PROTECTIVE COATINGS

PART 1 - GENERAL

1.01 DESCRIPTION

The work included in this section consists of the furnishing of all labor, materials, apparatus, scaffolding, and all appurtenant work in connection with painting.

A. WORK INCLUDED: In general, the following surfaces are to be painted or coated:

1. Exposed piping and other ferrous metal surfaces, interior and exterior.

2. All structural and miscellaneous steel.

3. All specifically designated concrete surfaces.

4. Equipment furnished without factory finished surfaces.

5. Recoating equipment to a specific color assignment.

6. All pumps, piping, gear heads and motors.

7. All equipment furnished with a factory applied or specified fusion bonded epoxy and intended outdoor use, shall be prepared and overcoated with a U.V. resistant coating as specified herein (System P2) whether specifically indicated or not.

B. RELATED WORK NOT INCLUDED: In general, the following surfaces shall not be painted:

1. Non-ferrous metals and fiberglass unless otherwise noted or indicated. (Galvanized metal shall not be considered a non-ferrous metal.)

2. Concrete surfaces subject to pedestrian traffic (unless otherwise designated).

3. Electrical and mechanical equipment furnished with baked enamel surface and exempted by the Owner (unless otherwise designated).

C. PAINT REQUIRED: In no case shall any concrete, wood, metal, or any other surface requiring protection be left unpainted even though not specifically defined herein.

D. SCAQMD COMPLIANCE: The Contractor shall determine and the Owner (Inspector) shall verify that the products used on this project are in compliance with all current South Coast Air Quality Management Owner's requirements including volatile organic chemicals (VOC).

E. PROTECTION OF THE WORK:

1. The Contractor shall take the necessary steps to protect the work of others during the time his work is in progress. The Contractor shall be responsible for any and all damage to the work.

2. Motors, pumps, and other equipment that might be damaged by sandblasting and that are furnished with approved, factory-applied finish shall be solvent cleaned, lightly sanded to break the glaze, and given one (1) coat of painting System "P2" per Section 2.01 herein. The Owner shall be the final judge as to which equipment the above requirement applies. Color shall be as determined by the Owner. Paint shall not be applied while equipment is operating.

1.02 QUALITY ASSURANCE

A. MATERIALS:

1. P-1, P-2 Paint: All materials specified by name and/or manufacturer, or selected for use under these specifications shall be delivered unopened at the job site in their original containers and shall not be opened until inspected by the Owner. Whenever a manufacturer's brand name is specified, it is intended to define the general type and quality of paint desired. Other coatings of the same type and of equal quality may be used only with prior written approval of the Owner. No coating, paint, varnish, epoxy or stain shall be reduced or applied in any way, except as herein specifically called for or if not specifically called for, then it shall be applied in accordance with the manufacturer's published recommendations.

2. P-11 Powder Epoxy: Epoxy shall be spray applied as a powder to heated metal by the Electrostatic Method, as specified herein.

a. The fluidized bed or dipped method shall not be used.

b. Electrostatic Application Method: The powder shall be spray applied to the heated, grounded metal part which has been

electrostatically charged by means of a current of approximately 1 1/2 amperes at 400 volts. After spray application of the epoxy powder, the part shall be reheated to the temperature and for the elapsed time specified by the coating manufacturer to ensure complete fusion and cure. Particular care shall be taken to protect non-ferrous masked parts. The finished product shall be carefully examined for epoxy interference on working parts and threaded holes or studs from receiving coating that will interfere with operation of the coated part.

c. Fusion epoxy powder to be used in contact with potable water shall be in compliance with NSF-61.

d. Thickness of Coating: The minimum dry coating thickness shall be 12 to 14 mils provided, however, that the thickness of coating in the grooves for valves of fittings designed to receive a rubber gasket shall be approximately 5 mils.

3. Liquid Epoxy: Where the size of the valve, part or other item is too large to be coated by the powder epoxy method with the written approval of the Owner, it shall be prepared in accordance with the requirements specified herein for System P12 and coatings shall conform to the following requirements.

a. Preparation: The surface shall be prepared per SP-10.

b. Thickness of Coating: The liquid epoxy shall be applied in multiple spray coats to a minimum total dry film thickness of 12 mils.

c. Application and Cure: The first coat of liquid epoxy shall be spray applied to the prepared surface within four (4) hours after completion of sandblasting. All items to be coated and the epoxy to be applied shall be at a minimum temperature of 50° F. and a maximum surface temperature of 100° F. at time of application. The first coat shall be air-dried with adequate ventilation for five (5) days at a minimum temperature of 65° F. Subsequent coats shall be applied per the recoat specification of the manufacturer.

B. COLOR SELECTION: All color sections shall be subject to approval of submittals by the Owner.

C. REJECTION: The completed coating will be inspected for quality, cure and mil thickness when received. Any color transfer, with or without acetone or MEK test would consider the P11 coating improperly or

incompletely cured. Any deficiency in these areas as outlined in this specification will be cause for rejection. Recoating over existing deficient coating in the P11 system is not permitted. Removal of deficient coating, re-prep and recoating to meet the specification requirements is at the Contractor's expense and no additional cost to the Owner.

D. PRIMER AND INTERMEDIATE COATS: Primer and intermediate coats of paint shall be unscarred and completely integral at the time of application of each succeeding coat. Each coat shall be subject to the inspection and approval of the Owner before the next succeeding coat is applied, and defective work of any kind shall be deemed sufficient cause for recoating the entire surface involved.

Sufficient time shall be allowed between coats to insure proper drying, unless these specifications or manufacturer's recommendations specifically state otherwise. Excessive time or exposure between coats shall not occur in cases where such excessive time or exposure will impair the bond between coats. Refer to manufacturer's product data sheets.

1.03 SUBMITTALS

Submit samples of field-applied paint and coating finishes, colors, and covering at least 60 days prior to start of such finishing operations.

A. IDENTIFICATION: Label or tag each sample or set of samples identifying the manufacturer's name and address, brand name, catalog number, project title, and intended use.

B. COLORS, PATTERNS, AND TEXTURES: For items required to be of selected and approved colors, patterns, textures, or other finish, submit sufficient samples to show the range of shades, tones, values, patterns, textures, or other features corresponding to the instructions and requirements specified.

C. FACTORY FINISH COLORS: Colors of material specified to be furnished with a factory finish are subject to approval. Submit duplicate samples of factory finishes showing the full range of available colors for selection and approval.

PART 2 - PRODUCTS AND MATERIALS

2.01 PROTECTIVE COATING MATERIALS

		NSF	
P1	Epoxy Primer	☐	Tnemec Series L69 ICI Paints – BAR-RUST® 231
P1A	Organic Zinc Primer	☐	Tnemec Series 90-97 (Shop Primer) Series 94 H20 (Field) CATA-Coat ® 302H Reinforced Inorganic Zinc
P2	Polyurethane Finish	☐	Tnemec Series 1081 ICI Paints – DEVTHANE ® 378H
P3	Rubber primer	☐	Polyken Plicoflex
P4	PVC 20-mil tape	☐	Polyken tape Plicoflex tape Denso Tape Systems
P5	Coal Tar Epoxy	☐	Tnemec 46 H-413 ICI Paints – DEVTAR® 5A-HS
P6	Coal Tar Mastic	☐	Tnemec 46-H 413 ICI Paints - DEVTAR® 5A-HS
P7	Epoxy Universal Primer	☐	Tnemec Series 27B ICI Paints – DEVRAN ® 203
P8	Grease	☐	Chevron E.P. Roller Grease or Texaco Rust Inhibitive Grease
P9	Heat Resistant Silicone Aluminum	☐	Devoe HT-12 High Heat Silicone Coating Thermox 230

P10	Vinyl Wash Primer	☐	Tnemec-Not required. See Tnemec Technical Memo #98-09
P11	Epoxy Coating - Powder	☒	3M Scotchkote 134
P11A	FBE Repair Coating	☒	3M Scotchkote 314
P12	Epoxy Coating - Liquid	☒	Keysite 750 (White) Tnemec 20 or Series N140F
P13	Waterproofing	☐	Regular Rainguard Regular Penetreat-50 Rainproof Okon Tnemec's Chemprobe dura Pel GS, Series 626
P14	Acrylic Latex	☐	ICI Paints – DEVFLEX™ 4216HP

2.02 SURFACE PREPARATION AND COATING THICKNESS

ITEM		SURFACE PREPARATION	FIRST COAT	SECOND COAT	THIRD COAT	MIN. TOTAL DRY FILM THICKNESS (MILS)
1.	Ferrous Metal Surfaces					
	A. Exposed	SP6	P1A	P1	P2	11.0
	B. Submerged	SP10	P5	P5	--	20.0
	C. Underground	SP3	P6	P6	--	32.0
	D. Subjected to High Temp. (300°+F.)	SP6	P9	P9	--	2.0
	E. Wearing Surfaces	None	P8	--	--	50.0
2.	Steel Pipe					
	A. Interior (if not CML)	SP10	P11	--	--	14.0
	B. Exterior/Buried (if concrete encased)	SP6	P7A	--	--	5.0
	C. Exterior/Buried (if not CMC or concrete encased)		P3 (Coated and wrapped per current AWWA C-203)	P4		
	D. Exterior/Above Grade	SP6	P1A	P1	P2[1]	11.0
3.	Ferrous Metal Valves	(AS DESCRIBED FOR ITEM 1)				
	A. Exterior	SP10	P11 or	--	--	12.0
	B. Interior	SP10	P12[3]	P12	P12[1]	12.0
4.	Black Steel Pipe (Buried)	SP3	P3	P4	--	40.0
5.	Galvanized Surfaces					
	A. Coated in addition to galv.	SP3 (Acid Wash & Wash Prime) [4]	P10	P1	P2	9.0
	B. Buried	SP3	P3	P4	--	40.0
6.	Structural Steel					
	A. Shop Primed	SP6	P1A	P1	P2	10.0
	B. Not Shop Primed	SP6	P1A	P1	P2	10.0
7.	Mech. Equip. w/Factory Finish		Spot			
	A. Field Applied Touch-up	SP2	P7	P2	--	5.0[2]

[1] Where required by manufacturer to meet minimum DFT requirement.
[2] Check for coating compatibility with existing factory finish.
[3] Only if necessitated by conditions.
[4] If required by coating manufacturer.

2.03 COLOR AND PAINT SCHEDULE

PROCESS SYSTEM	DESCRIPTIVE COLOR CODING	MANUFACTURERS' COLOR DESIGNATION	PIPE LABEL
All exposed piping not within building or structures	Desert Sands	04BR	(as approp.)
Air, Low Pressure	Light Green	PPA30	Compressed Air (as approp.) psig
Air, High Pressure (over 50 psi)	Light Green w/Yellow Bands	PA30/ SC 01	Compressed Air (as approp.) psig
Gas & LPG	Light Yellow	SC 01	Gas
Wash Water	Red	06 SF	Wash Water
Potable Water	Light Blue	25 BL	Water
Supply Oil Lines	Light Gray	10-1009	Supply Oil
Drain Oil Lines	Dark Gray	10-1092	Drain Oil
Engine Cooling Lines Water	Orange	03 SF	Engine Cooling
Sewage Pump Facility	Green	09 SF	All Piping
Raw/Recycled/Irrig. Water Facility	Purple	14 SF	Al Piping

The Owner reserves the right to make modifications to the color identifications schedule outlined above.

Color designations indicated are per Tnemec and may be cross referenced.

Contractor shall submit color charts to Owner for approval.

2.04 IDENTIFICATION OF PIPING

A. PIPING SYSTEMS: Identification of piping systems shall conform to the requirements of ANSI A13.1, "Scheme for the Identification of Piping System," unless otherwise specified herein.

B. COLOR IDENTIFICATION: All exterior exposed and/or unburied pipe outside of a structure, including tubing, galvanized pipe, polyvinyl chloride pipe and fiberglass reinforced pipe, shall be painted "Desert Sands". Stainless steel pipe and all other pipe not readily receptive to a painted finish maybe left natural. Markers shall be adhesive type with extra strength and suitable for continuous duty at 250° and UV resistant. All markers shall have a protective silicone film.

All piping within a structure shall be coated in the color indicated in the table above.

Each utility shall be clearly labeled with 1" high lettering on piping 2" in diameter and larger; on pipes 1/2" to 2" in diameter the lettering height shall be 1/2 of the pipe diameter; on piping/tubing smaller than 1/2" diameter. A sheet metal band shall be formed around the pipe and extend 1" beyond on front and back to form a "Flag". The sheet metal "Flag Band" shall be 1" wide and made of a material that is not detrimental to the host piping. The front and back Flag shall be riveted together at each end to affix permanently to the host pipe. The lettering height on the "Flag" shall be 1/2".

C. The unit suction/discharge piping, pumps, discharge heads and electric motors shall be painted light blue for potable water; green for sewage and purple for raw or recycled water (see "Color and Paint Schedule" in Section 2.03); and shall show flow arrows.

Contractor shall submit color charts to Owner for approval.

PART 3 - EXECUTION

3.01 PREPARATION

A. PAINT:

1. Surface Preparation: The Contractor shall examine carefully all surfaces to be finished and before beginning any of his work shall see that the work of the other trades has been left or installed in a workmanlike condition to receive paint. Metals shall be clean, dry, and free from mill scale, rust, grease, and oil.

Except as otherwise provided, all preparation of metal surfaces shall be in accordance with Specifications SP-1 through SP-10 of the Steel Structures Painting Council (SSPC). Grease and oil shall be removed by wiping with mineral spirits or naptha per Specification SP-1. Rust, scale, welding slag, and spatter shall be removed and the surface prepared by hand tool cleaning, power

tool cleaning, or blast cleaning in accordance with the appropriate Specification SP-2 through SP-10.

2. Mixing: Paint containers shall be new, factory sealed and opened only when required for use. Paint shall be mixed only in designated rooms or spaces in the presence of the Owner. Paint shall be thoroughly stirred or agitated to uniformly smooth consistency suitable for proper application. In all cases, paint shall be prepared and handled in a manner to prevent deterioration and inclusion of foreign matter.

B. LIQUID EPOXY COATINGS: Prior to coating preparation, all oil and grease shall be removed from the metal by caustic degreasing or steam cleaning. The surface shall be sandblasted to near-white metal in accordance with SSPC-SP10. In order to obtain maximum adhesion of epoxy coating, the grit used for blasting shall be coarse enough to impact a tooth in the metal equal to 25% of the thickness of the coating to be applied. The metal shall be cleaned, after sandblasting, with clean, dry compressed air. Use of rags to remove residual dust after sandblasting will not be permitted. Epoxy coatings shall be mixed only as needed and any material not used during manufacturer's published "pot life" shall be discarded.

C. VENTILATION: The Contractor shall not permit painting to begin in enclosed places until a forced draft ventilation system of sufficient air volume has been placed in operation.

D. POWDER EPOXY: The Contractor shall specifically verify the coating applicator's qualifications before subcontracting the work to him. Where the size of the valve or other item is not too large, it shall be coated by the electrostatically sprayed powder epoxy method. Application of powder epoxy shall conform to the following requirements:

E. PREPARATION: Prior to coating preparation, all oil and grease shall be removed from the metal by caustic degreasing or steam cleaning. The surface shall be sandblasted to near-white metal in accordance with SSPC-SP10. In order to obtain maximum adhesion of epoxy coating, the grit used for blasting shall be coarse enough to impact a tooth in the metal equal to 25% of the thickness of the coating to be applied. The metal shall be cleaned, after sandblasting, with clean, dry compressed air. Use of rags to remove residual dust after sandblasting will not be permitted.

F. PREHEATING: Areas that are not to be coated shall be masked using 500° F. masking tape, similar to Permacel, as manufactured by Minnesota Mining and Manufacturing Company. The part to be coated shall be placed in an oven and preheated to the temperature specified by the epoxy manufacturer. An accurate temperature measuring device such as a

pyrometer shall be used to determine the substrate temperature. The epoxy powder shall then be applied by the electrostatic spray method.

G. CURING: Then the coated piece shall be reheated in the oven to the temperature and for the duration prescribed by the coating manufacturer. The powder epoxy shall be applied to the full DFT in one coat. Once the coating process is complete, the DFT will be verified by the coating applicator's quality control personnel and documented. The documentation shall be made available to the Owner. The coating quality and thickness will be verified by the Owner at the coating facility or at the site after delivery. Should the DFT be insufficient or substandard in any way, the original FBE coating will be completely removed and the part recoated to specifications at no additional cost to the Owner.

3.02 APPLICATION OF PAINT. The applicator of the paint shall be qualified and have had past experience in successfully applying the type or types of coatings and under similar conditions that he will be required to meet in this contract. The Contractor shall verify the paint applicator's qualifications before subcontracting the work to him.

No painting shall be done under windy or dusty conditions, during or immediately after a rain, during rainy weather, or when the temperature is less than 50° F.

Except that prime coats shall be applied by brush and well worked into the surface, paint may be applied by brush, roller, or spray, unless the manufacturer's recommendations or these specifications call for some particular type of application. Where spray application is used, each coat of paint shall be applied to a thickness equivalent to a brush coat application at a coverage not greater than that specified by the manufacturer for a brush coat application.

All work shall be done in workmanlike manner, leaving the finished surfaces free from drops, runs, waves, holidays, laps, voids, or brush marks. Drop cloths, masking and other coverings shall be so placed at all times as to protect floors and other surface from spatter and droppings. Hardware, switch-plates, lighting fixtures, nameplates, brass fittings and similar articles which are not to be painted shall be masked off or removed completely. After completion of painting, any spatter or droppings shall be removed.

The number of coats or mils specified is the minimum to be applied. Irregular spots and holidays between coats shall be touched up, and additional coats shall be provided if required to produce a finished surface of solid, even color, free from overspray and defects. The total thickness of the coating shall be as specified. Additional coats of paint shall be added if necessary to bring the total thickness up to not less than that specified. No holidays shall be left in the finished product. Particular care shall be used to assure that the specified coverage is secured on the edges and corners of all surfaces. Additional brush coats shall be applied if necessary to cover the edges and corners. The Contractor shall control and check the dry film thickness of the coatings on metal surfaces with a correctly calibrated thickness meter and shall check for holidays with a low-voltage

holiday detector. The Owner may use the Contractor's meter and detector for additional checking.

Damaged paint or scratched painted surfaces shall be sanded smooth before repainting. Sanding areas to be repainted shall be done to such a degree and in such a manner that all evidence of the scratches or damages are obscured and the proper DFT is achieved.

3.03 CLEAN-UP

Upon completion of his work, the painting contractor shall remove his surplus materials. All paint spills shall be removed entirely and completely and the entire premises shall be free from rubbish, debris, etc. caused by his work. He shall present the work clean and free from blemish so that it is acceptable in every way. Spills and cleanup residue must be prevented from penetrating the soil.

3.04 PAINT TO BE PROVIDED TO OWNER

At the end of the project, the Contractor shall turn over to the Owner; one unopened gallon can of each type and color of paint, catalyst primer, thinner, or other coating used in the field painting. If the manufacturer packages the material concerned in gallon cans, then it shall be delivered in unopened labeled cans as it comes from the factory. If the manufacturer does not package the material in gallon cans, and in the case of special colors, the materials shall be delivered in new gallon containers, properly closed with typed labels indicating brand, type, color, etc. The manufacturer's literature describing the materials and giving directions for their use shall be furnished in three (3) bound copies. A typewritten inventory list shall be furnished at the time of delivery.

3.05 WARRANTY INSPECTION

Warranty inspections shall be conducted during the eleventh (11th) month following completion of all coating work. All personnel present at the pre-job conference shall be present at this inspection. All defective work shall be repaired in strict accordance with this specification and to the satisfaction of the Owner.

END OF SECTION 09871

SECTION 09875

EPOXY COATING FOR CONCRETE WASTEWATER STRUCTURES

PART 1 - GENERAL

1.01 DESCRIPTION

This section covers all workmanship, materials and quality requirements for providing and applying a high-build epoxy coating for protecting concrete wastewater structures and manholes in order to eliminate infiltration and provide corrosion protection.

1.02 SCAQMD COMPLIANCE

All coatings shall be in compliance with all Air Quality Management District requirements including volatile organic compounds (VOC).

1.03 REFERENCES

A. GENERAL: The references indicated herein 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 most stringent of the requirements shall govern.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of receipt of bid proposals. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued, or replaced.

Referenced publications found within this specification shall be the latest revision unless otherwise specified; and applicable parts of the referenced publications shall become a part of this specification as if fully included.

B. REFERENCE STANDARDS:

A. ASTM D638 - Tensile Properties of Plastics.

B. ASTM D790 - Flexural Properties of Unreinforced and Reinforced Plastics.

C. ASTM D695 - Compressive Properties of Rigid Plastics.

D. ASTM D4541 - Pull-off Strength of Coatings Using a Portable Adhesion Tester.

E. ASTM D2584 - Volatile Matter Content.

F. ASTM D22409 - Durometer Hardness, Type D.

G. ASTM D543 - Resistance of Plastics to Chemical Reagents.

H. ASTM C109 - Compressive Strength Hydraulic Cement Mortars.

I. ASTM C396 - Compressive Strength of Cement Mortars.

J. ACI 506.2-77 - Specifications for Materials, Proportioning, and Application of shotcrete.

K. ASTM C579 - Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars.

L. ASTM - The published standards of the American Society for Testing and Materials, West Conshohocken, PA.

M. NACE - The published standards of National Association of Corrosion Engineers (NACE International), Houston, TX.

N. NACE - RP0892-92 – Standard Recommended Practice, "Lining Over Concrete in Immersion Service".

O. SSPC - The published standards of the Society of Protective Coatings, Pittsburgh, PA.

1.04 QUALITY ASSURANCE

A. GENERAL: Quality assurance procedures and practices shall be used to monitor all phases of surface preparation, application and inspection throughout the duration of the project. Procedures or practices not

specifically defined herein may be used provided they meet recognized and acceptable professional standards and are approved by the Owner.

B. INSPECTION BY OWNER: All materials furnished and all work accomplished under the Contract shall be subject to inspection by the Owner. The Contractor shall be held strictly to the true intent of the Specifications in regard to quality of materials, workmanship, and diligent execution of the requirements of the Contract.

Except as otherwise provided herein, the cost of inspection will be paid by the Owner.

C. FIELD TESTS: The Owner will make, or have made, such tests as deemed necessary to assure the work is being accomplished in accordance with the requirements of the Contract. Unless otherwise specified in the Special Requirements, the cost of such testing will be borne by the Owner. In the event such tests reveal non-compliance with the requirements of the Contact, the Contractor shall bear the cost of such corrective measures deemed necessary by the Owner, as well as the cost of subsequent retesting. It is understood and agreed the making of tests shall not constitute an acceptance of any portion of the work, nor relieve the contractor from compliance with the terms of the Contract.

D. OTHER QUALITY ASSURANCE REQUIREMENTS:

1. Do not use or retain contaminated, outdated, or diluted materials for resurfacing. Do not use materials from previously opened containers.

2. Use only products of the approved Manufacturer. Use products of one manufacturer in any one resurfacing system with compatible materials. Provide same material product for touch-up as for original material.

3. If any requirements of this specification conflict with a referenced standard, the more stringent requirement shall apply.

4. Make available all locations and phases of the work for access by the Owner or other personnel designated by the Owner. The Contractor shall provide ventilation and egress to safely access the coating work areas for inspection.

5. Conduct work so that the resurfacing system is installed as specified herein. Inspect work continually to ensure that the resurfacing system is installed as specified herein. The Contractor shall inspect the work to determine conformance with the specifications and referenced documents. The Contractor shall inform the Owner of the progress and the quality of the work through daily reports as specified below. Any nonconforming

coating system work shall be corrected as specified herein or as recommended by the Manufacturer.

6. Summarize test data, work progress, areas covered, ambient conditions, quality control inspection test findings, and other information pertinent to the resurfacing system installation in daily reports to be submitted to the Owner or the Owner's Representative.

7. The methods of construction shall be in accordance with all requirements of this specification.

8. Employ only trades people who have at least **three years** of experience performing resurfacing work of similar size and complexity as the work specified in this Section. Submittals to verify these qualifications are to be made within thirty (30) days of the Notice-to-Proceed and are subject to approval by the Owner.

9. The Specified System is the minimum standard of quality for this project. Submissions of alternative manufacturers shall be in accordance with provisions stated in the Special Requirements.

1.05 PRE-COATING CONFERENCE

A. A Pre-Coating Conference shall be scheduled prior to start of project. The Owner, Contractor, Coating Manufacturer's representative and Owner shall be present. A schedule of work to be accomplished and a list of labor, material and equipment rates for additional work will be established and maintained throughout the project. Contractor shall furnish submittal data per Section 01340. Resumes of personnel to be used on the project shall be submitted.

B. The Contractor shall submit, prior to the Pre-Coating Conference, manufacturers' literature and Material Safety Data Sheets on all materials to be used in coating and painting operations, including, but not limited to coatings, paints, thinners, solvents and cleaning fluids per Section 01340. Contractor shall maintain copies of submittal data at jobsite at all times.

1.06 SUBMITTALS

A. GENERAL: Submit shop drawings, coating data and related information in accordance with the General Conditions.

B. TECHNICAL DATA SHEETS: Submit technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these specifications.

C. MSDS: Submit Material Safety Data Sheets (MSDS) for each product used.

D. GUIDELINES: Project specific guidelines and recommendations.

E. APPLICATOR QUALIFICATIONS:

1. Manufacturer certification that Applicator has been trained and approved in the handling, mixing and application of the products to be used.

2. Certification by the protective coating manufacturer that the equipment to be used for applying the products has been approved and Applicator personnel have been trained and certified for proper use of the equipment.

3. Five (5) recent references of Applicator (projects of similar size and scope) indicating successful application of a high-build solvent-free epoxy coating by spray application.

4. Proof of any necessary federal, state or local permits or licenses necessary for the project.

5. Submit applicator's certification that resurfacing materials comply with Federal, State, and Local regulations for VOC (Volatile Organic Compounds).

6. Submit daily reports that contain the following information: substrate conditions, ambient conditions, application procedures, work completed and location thereof. Mark-up drawings that show location of work.

7. Submit letter(s) with associated product data signed by Manufacturer certifying that submitted products are suitable for application on the surfaces to be resurfaced and for the service conditions.

F. DESIGN DETAILS: Submit design details for any additional ancillary systems and equipment to be used in site and surface preparation, application and testing.

1.07 DELIVERY AND STORAGE

A. GENERAL: Materials shall be stored in accordance with Manufacturer's recommendations in enclosed structures and shall be protected from weather and adverse temperature conditions. Flammable materials shall be stored in accordance with state and local codes. Materials exceeding

storage life recommended by the manufacturer shall be removed from the site.

B. STORAGE: Store all materials only in area or areas designated by the Owner solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of materials-related debris before authorized disposal, to these areas. All materials are to be stored on pallets or similar storage/handling skids off the ground in sheltered areas in which the temperature is maintained between 50^{o}F and 90^{o}F.

C. MIXING: Mix all resurfacing materials in an enclosed mixing area designated by the Owner. This enclosed area must protect the mixing operation and materials from direct sunlight, inclement weather, freezing, or other means of damage or contamination. Protect all other concrete and metallic surfaces and finishes from any spillage of material(s) within the mixing area.

D. DISPOSAL: Contractor shall be responsible for legal disposal of materials. Do not use floor drains, dikes or storm drains for disposal of resurfacing system materials.

E. PRECAUTIONS AGAINST HAZARDS: The Contractor shall take all precautions and implement all measures necessary to avert potential hazards associated with the resurfacing system materials as described on the pertinent Material Safety Data Sheets or container labels.

E. DELIVERED MATERIALS: Deliver all materials to the jobsite in their original, unopened containers. Each container shall bear the Manufacturer's name and label.

1. Labels on all material containers must show the following information:

   a. Name or title of product.
   b. Federal Specification Number if applicable.
   c. Manufacturer's batch number and date of manufacture.
   d. Manufacturer's name.
   e. Generic type of material.
   f. Application and mixing instructions.
   g. Hazardous material identification label.
   h. Shelf life date.
   i. Storage requirements.

2. All containers shall be clearly marked indicating any personnel safety hazards associated with the use of or exposure to the materials.

3. All materials shall be handled and stored to prevent damage or loss of label.

4. Resurfacing material storage and mixing areas shall be designated by the Owner.

5. Do not use or retain contaminated, outdated, prematurely opened, diluted materials, or materials which have exceeded their shelf life.

1.08 SAFETY

A. COMPLIANCE WITH STANDARDS: The Contractor's work forces should comply with the provisions outlined in the following documents:

1. SSPC-PA-3 "A Guide to Safety in Paint Application"
2. NACE Pub. "A Manual for Painter Safety"
3. OSHA 1915.35 Standards – 29CFR – Painting Safety

B. SAFETY EQUIPMENT: The Contractor shall provide personnel with all safety equipment necessary to protect them during any phase of the work. This shall include, but not be limited to, safety glasses, goggles, earplugs, hard hats, steel toed work shoes, appropriate personal protective clothing, gloves, and plant approved escape respirators (where required).

C. FLAMMABLE MATERIALS: Keep any flammable materials such as cleaning solvents, thinners, or resurfacing materials away from open flames, sparks or temperatures higher than 150^{o}F. Drums containing flammable materials will be grounded. No solvent in any quantity shall be allowed inside containment enclosures or permitted confined spaces at any time during resurfacing work.

D. POWER TOOLS: Power tools are to be in good working order to avoid open sparking. No spark producing tools shall be utilized in restricted areas as indicated herein.

E. FIRE PROOFING: The Contractor shall fireproof all work areas by maintaining a clean work area and having Underwriter's Laboratories approved fire extinguishers on-hand. The Contractor shall furnish these fire extinguishers.

F. ABRASIVE BLASTING: Workers doing abrasive blasting operations shall wear a fresh air supplied protective helmet and hood and personal protective clothing acceptable to industry standards and all government regulations.

G. DISPOSAL OF RAGS: Dispose of rags used for wiping up resurfacing materials, solvents, and thinners by drenching them with water and placing

in a metal container with a tight fitting metal cover. Complete this disposal process at the end of each day. Final disposal of these materials is the Contractor's responsibility.

H. FLAMES AND SPARK REQUIREMENTS: Matches, smoking, flames, or sparks resulting from any source including welding, must be remote from the work area during coating work. Smoking is permitted only in designated areas of the plant.

1.09 WARRANTY

The coating shall carry an extended warranty for a two-year period from the date of acceptance. All warranties shall be turned into the Owner prior to project acceptance. Contractor shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said two (2) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

Approved manufacturers are:

1. Raven Lining Systems, Inc.; Tulsa, Oklahoma (800-324-2810).

2. Tnemec Company; Kansas City, Missouri (800-863-6321).

2.02 MATERIALS

A. EPOXY LINING SYSTEM: The epoxy lining system shall be a high-build, 100% solids, solvent-free epoxy system; and shall be one of the following:

1. Raven 404

2. Tnemec Company products:

a. Surfaces: MortarClad – Series 218
b. Lining: Perma-Shield H_2S – Series 434
c. Topcoat/gelcoat: Perma-Glaze – Series 435

B. MATERIALS TESTING REQUIREMENTS: Materials specified shall have been tested in a Severe Accelerated Wastewater Test. Submit evidence of successful test results to Owner.

C. SEALANTS: Refer to Section 07920.

D. ABRASIVE BLAST MEDIA: If dry or wet abrasive blast cleaning is the selected method of surface preparation, provide slag grit of a sieve size, gradation, and quality necessary to produce the degree of cleanliness and surface profile required herein (ICRI Guideline 03732, CSP-5 and SSPC-SP13/NACE No. 6).

E. REPAIR MATERIALS: Repair materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces, etc. as determined necessary by the Owner and protective coating applicator. Repair materials must be compatible with the specified epoxy coating and shall be applied in accordance with the manufacturer's recommendations.

PART 3 – EXECUTION

3.01 GENERAL

A. HOISTING, SCAFFOLDING, STAGING, AND PLANKING:

1. Provide, set-up, and maintain all required hoists, scaffolds, and staging and planking, and perform all access related hoisting work required to complete the work of this section as indicated and specified.

2. Scaffolds shall have solid backs and floors to prevent dropping materials from there to the floors or ground below.

B. ENVIRONMENTAL REQUIREMENTS:

1. Comply with the Manufacturer's recommendations as to environmental conditions under which resurfacing system materials can be applied.

2. Do not apply resurfacing system materials when dust is in work site.

3. The Contractor shall provide all temporary lighting during the work.

C. PROTECTION:

1. Cover or otherwise protect finish work or other surfaces not being resurfaced.

2. Erect and maintain protective tarps, enclosures and/or maskings to contain debris (such as dust or airborne particles resulting from surface preparation) generated during any and all work activities. This includes, but is not limited to, the use of dust/debris collection apparatus as required.

D. INITIAL INSPECTION OF SURFACES TO BE COATED: It is the responsibility of the Contractor to inspect and report unacceptable concrete substrate surface conditions to the Owner prior to the commencement of surface preparation activities. Unacceptable surface conditions are defined as the presence of cracked surfaces or concrete deteriorated to a depth of greater than 1" or otherwise unable to withstand surface preparation as specified herein.

E. THINNERS AND SOLVENTS: The Contractor shall use only solvents and thinners as recommended by the Manufacturer.

3.02 ACCEPTABLE APPLICATORS

A. TRAINING: Applicators shall be trained to properly apply the coating according to manufacturer's recommendations.

B. APPLICATOR CERTIFICATION: Protective coating must be applied by a Certified applicator of the protective coating manufacturer and according to manufacturer specifications.

3.03 CURING OF NEW CONCRETE

Portland cement or new concrete must be well cured (28 days minimum) prior to application of the protective coating. Contractor shall account for this curing time in his bid proposal, and no additional Contract Time extension will be allowed therefore.

3.04 SURFACE PREPARATION REQUIREMENTS

A. GENERAL: The following general requirements shall apply to all surface preparation:

1. Applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation. Applicator shall notify Owner of any noticeable disparity in the surfaces which may interfere with the proper preparation or application of the specified protective coating.

2. All contaminants including: oils, grease, unsound or incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.

3. All specified surface preparation shall be performed in accordance with the latest version of the SSPC, NACE, ICRI and other standards referenced in this section.

4. Concrete surfaces shall be abraded to produce a minimum surface profile as recommended by the coating manufacturer. This preparation will be followed by vacuum cleaning to remove all dust, dirt or friable substances leaving clean, dust free surfaces for resurfacing as detailed in SSPC-SP 13/NACE No. 6).

5. The air used for blast cleaning shall be free of oil and moisture to not cause contamination of the surfaces to be resurfaced.

6. Clean cloths and clean fluids shall be used in solvent cleaning.

7. Cleaning and resurfacing shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly resurfaced areas.

8. Prepare concrete joint and install sealant following resurfacing material installation per Section 07920.

B. INITIAL CLEANING/DECONTAMINATION:

1. All existing areas to be resurfaced shall be pressure washed with alkaline –based detergent to remove all loose materials, acid constituents, grease, oil, and other contaminants.

2. Verify that the pH of the cleaned concrete surfaces to be coated is within the range of to 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Owner.

C. ABRASIVE BLAST CLEANING

1. Used or spent blast abrasive shall not be reused on work covered by this section.

2. The compressed air used for blast cleaning will be filtered free of condensed water or oil. Moisture traps will be cleaned at least once every four hours or more frequently as is appropriate.

3. Oil separators shall be installed just downstream of compressor discharge valves and at the discharge of the blast pot discharges. Oil separators shall be cleaned at least once every four hours or more frequently as is appropriate.

4. A paper blotter test shall be performed by the Contractor when requested by the Owner or the Owner's representative to determine if the air is sufficiently free of oil and moisture (Reference ASTM D 4285).

5. Regulators, gauges, filters, and separators will be in good working order for all of the compressor air lines to blasting nozzles at all times during this work.

6. An air dryer or drying unit shall be installed which dries the compressed air prior to blast connections. This dryer shall be used and maintained for the duration of surface preparation work.

7. The quality, volume, and velocity of life support and ventilation air used during surface preparation shall be in accordance with applicable safety standards and as required to ensure adequate visibility and proper dissipation of volatiles without impacting the prepared surface or the health of the public or personnel working for the Contractor, Subcontractors, Owner, Owner's representatives, or anyone who may be affected by on-site maintenance coating work activities.

8. The abrasive blast nozzles used shall be the venturi or other high velocity type supplied with the minimum air pressure and the necessary volume to obtain the required specified degree of cleanliness.

9. The Contractor must provide adequate ventilation for airborne particulate evacuation and lighting (meeting all pertinent safety standards) to optimize visibility for both blast cleaning and observation of the substrate during surface preparation work.

10. All phases of surface preparation work specified herein must be inspected by the Owner before the Contractor proceeds with the subsequent phase of surface preparation.

11. If, between final surface preparation work and coating application, contamination of the prepared and cleaned substrate occurs, or if the prepared concrete's appearance darkens or changes color, reblasting will be required until the specified degree of cleanliness is established.

3.05 SPECIFIC SURFACE PREPARATION REQUIREMENTS

A. SPECIFIC REQUIREMENTS: In addition to the paragraph 3.04 requirements, the Contractor shall follow the requirements of this section.

B. TERMINATIONS: Where the coating is specified to be terminated, the Contractor shall prepare and apply materials per the Manufacturer's recommendations.

C. PENETRATIONS: For applications around penetrations and/or drains, the contractor shall prepare and apply coatings in accordance with Manufacturer's recommendations. All hardware mounting bolts or studs shall be in place and masked with the hardware removed for the coating process. The coating shall contact the mounting bolts/studs so no break in the coating will occur.

D. FLOOR PITCH: When the floor area is scheduled to receive a mortar application to pitch the floor, the walls above the floor shall be sawcut to a depth of 1/2 inch at a height from 0’-0” to 0’-6” above the floor. The cut shall be straight and level.

E. NOTIFICATION TO OWNER: The Contractor shall notify the Owner should jobsite conditions prevent the above operations and/or applications.

3.06 APPLICATION REQUIREMENTS

A. GENERAL: The following general application requirements shall apply to the project:

1. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment.

2. When spray equipment is used, the spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.

3. Areas not to be resurfaced shall be masked using duct tape or other protection materials to prevent these surfaces from being resurfaced.

4. Ensure straight, even termination of resurfacing/topcoat materials on wall edges and flush with embedded steel.

5. The Contractor must follow the minimum and maximum recoat limitation times and related temperature range restrictions between successive lifts for all products specified herein per Manufacturer's stated requirements.

6. All equipment and procedures used for resurfacing system application shall be as recommended by the Manufacturer.

7. Unless specified elsewhere herein, the Contractor shall comply with the Manufacturer's most recent written instructions with respect to the following:

   a. Mixing of All Materials.
   b. Protection and Handling of All Materials.
   c. Recoat Limitation and Cure Times.
   d. Minimum Ambient and Substrate Temperatures, Substrate's Degree of Dryness, Relative Humidity, and Dew Point of Air.
   e. Application.
   f. Final Curing.
   g. Use of Proper Application Equipment.

8. Curing of Resurfacing System: The applied resurfacing system shall be protected from damage during curing and shall be cured as recommended by the Manufacturer. Ambient conditions shall be controlled by the Contractor during curing to ensure the minimum air temperature and minimum relative humidity as required by the Manufacturer is maintained.

B. CHEMICAL RESISTANT LINING: The following shall apply to the specified Tnemec Coating System:

1. General Note: The Contractor is advised that with all thick-film, quick curing materials applied to concrete surfaces, outgassing of the concrete may occur. Possible remedies include applying materials when the temperature of the concrete surfaces is descending, or applying a thin (1/16") layer of the specified surfacing material. Other remedies may exist, and may be submitted for the Owner's approval.

2. Fill all voids, bugholes and other surface imperfections with Tnemec Series 218 MortarClad.

3. Apply Tnemec Series 434 Perma-Shield H_2S chemical resistant mortar to all floor areas and walls scheduled to be coated at a nominal thickness of 125 mils. Application shall be either by trowel or spray. If spray-applied, material shall be finish-troweled

and finish-rolled (Reference manufacturers application guides for explicit instructions).

4. Series 435 Perma-Glaze shall be a minimum of 15.0 mils thick upon cure regardless of the number of coats required.

C. SAFETY AND VENTILATION REQUIREMENTS: Requirements for safety and ventilation shall be in accordance with SSPC Paint Application Guide No. 3.

3.07 SPECIFIED APPLICATION THICKNESS

All interior surfaces of the wet well, diversion structure and junction manhole shall be coated as specified with a nominal dry film thickness of 125 mils.

3.08 FIELD QUALITY CONTROL INSPECTION AND TESTING

A. INSPECTION BY OWNER: Inspection by the Owner or others does not limit the Contractor's responsibilities for quality control inspection and testing as specified herein or as required by the Manufacturer's instructions.

B. QUALITY CONTROL PROCEDURES: Perform the quality control procedures listed below in conjunction with the requirements of this Section.

1. Inspect all materials upon receipt to ensure that all are supplied by the Manufacturer.

2. Provide specified storage conditions for the resurfacing system materials, solvents, and abrasives.

3. Inspect and record findings for the degree of cleanliness of substrates used. The pH of the concrete substrate will be measured using pH indicating papers. pH testing is to be performed once every 50 sq. ft. Acceptable pH values shall be between 8.0 and 11.0 as measured by a full-range (1-12) color indicating pH paper with readable color calibrations and a scale at whole numbers (minimum). Use Hydrion Insta-Check Jumbo 0-13 or 1-12 or equal. The paper shall be touched to the surface once using moderate gloved finger pressure. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not "wipe" the surface. Compare the color indicated with the scale provided and record the pH.

4. Inspect and record substrate profile (anchor pattern). Surfaces shall be abraded, as a minimum, equal to the roughness of CSP-5 ICRI Guideline 03732.

5. Measure and record ambient air temperature once every two hours of each shift using a thermometer and measure and record substrate temperature once every two hours using a surface thermometer.

5. Measure and record relative humidity every two hours of each shift using a sling psychrometer in accordance with ASTM E337.

6. Provide correct mixing of resurfacing materials in accordance with the Manufacturer's instructions.

8. Inspect and record that the "pot life" of resurfacing materials is not exceeded during installation.

9. Verify curing of the resurfacing materials in accordance with the Manufacturer's instructions.

10. Upon full cure, the installed lining system shall be checked by high voltage spark detection in accordance with NACE RP0188-90, and the manufacturer's printed application guide to verify a pinhole-free surface. Areas which do not pass the spark detection test shall be corrected at no cost to the Owner and rechecked

11. Upon completion of the lining system installation, the lined area shall be cleaned and prepared to permit close visual inspection by the Owner. Any and all deficiencies or defective work (not in compliance with this section or related sections) will be marked for repair or removal/replacement by the Contractor at no additional cost to the Owner.

C. TESTING: The following testing requirements shall apply as determined by the Owner.

1. During application a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414 – Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.

2. After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surfaces shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the

minimum/maximum voltage to be used to test the coating for holidays at hat particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.

3. Measurement of bond strength of the protective coating to the substrate can be made at regular intervals and along different sections of the structure (i.e. crown of pipe, wall, invert – every 200 ft). Bond strength can be measured in accordance with ASTM D4541. Any areas detected to have inadequate bond strength shall be evaluated by the Owner. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Applicator in strict accordance with manufacturer's recommendations.

4. A final visual inspection shall be made by the Inspector and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired according to the procedures set forth herein by Applicator.

3.09 ACCEPTANCE CRITERIA

A. ACCEPTANCE CRITERIA FOR SURFACE PREPARATION WORK: All surfaces shall be prepared in accordance with the specification and referenced standards therein.

B. ACCEPTANCE CRITERIA FOR COATING SYSTEM APPLICATION WORK: The following acceptance criteria for applicant work shall apply:

1. Acceptable coating work will be based upon the following:

   a. No pock-marks, trowel marks, depressions, unconsolidated areas, waviness or ridges, pinholes or holidays in either size or frequency.
   b. No intercoat bond failures between lifts.
   c. Proper curing of coatings.

2. Resurfaced areas shall pitch to drains.

3. There shall be no areas that puddle when flood tested.

4. The Owner or Owner's representative shall, at their discretion, inspect the following:

   a. Profile and degree of cleanliness of substrate.
   b. Thickness of materials/coverage rate confirmation.
   c. Ambient temperature and humidity requirements and substrate temperature.
   d. Curing and recoat times.
   e. Proper curing of the resurfacing materials.

5. Rework required on any holidays or any other inadequacies found by the Owner or the Owner's representative in the quality of the coating work shall be marked. Such areas shall be recleaned and reworked by the Contractor according to these specifications and the manufacturer's recommendations at no additional cost to the Owner.

6. The Contractor is responsible for keeping the Owner informed of all progress so that inspection for quality can be achieved.

7. The Contractor is ultimately responsible for the quality performance of the applied materials and workmanship. Inspections by the Owner or the Owner's representative do not limit this responsibility.

3.10 FINAL INSPECTION

Perform a final inspection to determine whether the resurfacing system work meets the requirements of the specifications. The Owner, the Contractor and the Manufacturer's representative will conduct the final inspection.

3.11 CLEANUP

Upon completion of work, the Contractor shall remove surplus materials, equipment, protective coverings, and accumulated rubbish, and thoroughly clean all surfaces and repair any work-related damage. The surrounding surface areas including roadways and all other surfaces shall be restored to their pre-project condition.

3.12 SERVICES OF MANUFACTURERS

A. GENERAL: The services described herein are for the field observation, inspection assistance and quality control for the specified coating applications. For purposes of this paragraph, a work day is defined as an 8-hour period at the site, excluding travel time. The Owner may require that the Manufacturer's services described herein be furnished in twelve (12) separate trips. Four (4) hours or less at the jobsite will be considered as one-half (1/2) of a working day.

B. MANUFACTURER'S ATTENDANCE JOBSITE: The service representative(s) of the manufacturer shall be present at the site during all major phases of the work (surface preparation, surface application, inspection and testing, etc.), for each facility or structure receiving the specified coating. For purposes of this specification, eight (8) working days of manufacturer's attendance at the jobsite shall be required.

END OF SECTION 09875

DIVISION 11

EQUIPMENT

DIVISION 11
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SECTION 11330
FINE SCREEN AND WASHING SYSTEM

PART 1 - GENERAL

1.01 SCOPE

A. The Contractor shall furnish and install One (1) Vertical Step Screen, a self-cleaning fine screen. The screen shall be manufactured from AISI 304L stainless steel shapes. The step screen shall not operate on a continuous basis. The screen controls shall enable the screen to be operated based on the differential between the water levels upstream and downstream of the screen. Ultrasonic level detectors shall be located upstream and downstream of the step screen to monitor water levels in the channel and initiate an operating cycle through the PLC.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

1. Section A322: Carbon and Alloy Steel Bar Specifications.
2. Section A507-10: Standard Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold Rolled

B. Anti-Friction Bearing Manufacturers Association (AFBMA) Publications:

1. Standard 9-90 Load Ratings and Fatigue Life for Ball Bearings.

2. Standard 11-90 Load Ratings and Fatigue Life for Roller Bearings.

C. American Institute of Steel Construction (AISC) Publications

D. American Welding Society (AWS) Publications

E. American Structures Painting Council (ASPC) Publications

1.03 SUBMITTALS

A. The following information shall be submitted to the engineer, In accordance with Section 01340, copies of all materials required to establish compliance with this Section. Submittals shall include the following:

B. Product data including the following:

1. Descriptive literature, brochures, and/or catalogs of the equipment.

2. Motor characteristics and performance information.

3. Gear reducer data including service factor, efficiency, torque rating, and materials.

4. Parts list including a list of recommended spare parts.

C. Shop drawings Including the following:

1. Manufacturer's installation drawings.

2. Wiring and schematic diagrams.

D. Operations and maintenance manual: See Section 01300.

E. Installation reference list.

F. Equipment weights and lifting points.

G. Recommendations for short and long term storage.

H. A copy of the manufacturer's warranty

I. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

J. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

1.04 QUALITY ASSURANCE

A. To ensure quality, conformance, and reliability with regard to the manufacturing and production of the equipment, the manufacturer shall meet all requirements listed hereafter:

B. Manufacturer shall have a minimum of twenty (20) years experience producing equipment substantially similar to that required and shall be able to submit documentation of at least fifteen (15) independent installations using the same size or larger equipment as detailed in the below. Each installation must have been in satisfactory operation for at least five (5) years.

C. The contract documents represent the minimum acceptable standards for the screening equipment for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. The entire unit shall be Manufacturer's standard product, but shall be modified, redesigned, furnished with special features or accessories, made of materials or provided with

finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of the specification.

D. The entire unit shall be manufactured from AISI 304L stainless steel shapes. All components made of stainless steel shall be passivated by full submergence in a pickling bath for perfect surface finishing. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are also fabricated, in order to prevent contamination by rust.

E. Electric motors, gear reducers, and other self-contained or enclosed components shall have an acrylic enamel finish.

F. All stainless steel parts of the unit shall be fully submerged into a pickling bath for at least 8 hours to remove welding spots and to protect the stainless steel against corrosion. Glass bead blast or chemically treated stainless steel shall not be allowed.

G. Fabrication shall be done in compliance with all applicable ASTM standards or equivalent international standards.

H. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section equal to or greater than the parent metal. Butt welds shall fully penetrate to the interior surface and gas shielding to interior and exterior of the joint shall be provided.

I. Bolts, nuts and washers shall be selected from AISI 304L or 316L stainless steel such that they are anti-seizing.

J. Manufacturer shall have established an ISO 9001 certified quality management system. Equipment suppliers not utilizing ISO 9001 facilities shall not be considered or approved for this project. Equipment supplier shall provide evidence of certification before being named as an acceptable manufacturer.

K. Manufacturer shall have established an ISO 14001 certified environmental protection management system designed to monitor and help minimize the harmful effects on the environment caused by its manufacturing processes. Equipment suppliers not utilizing ISO 14001 facilities shall not be considered or approved for this project. Equipment supplier shall provide evidence of certification before being named as an acceptable manufacturer.

L. All welding is performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code, or equivalent.

M. Manufacturer shall provide screen, wash press, motors, gear reducers, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination, compatibility, and operation of the system.

N. Supplier shall provide services by a factory-trained Service Engineer, specifically trained on the type of equipment specified. Service Engineer requirements include, but are not limited to the following:

1. A service engineer shall be present during initial energizing of equipment to determine directional testing as described in Section 4.01 C (Installation).

2. A Service Engineer shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.

3. A Service Engineer shall provide classroom and/or field training on the Operation and Maintenance of the equipment to operator personnel. These instructions may include the use of slides, videos, literature, and/or oral presentations.

4. Manufacturer shall state field service rates for a Service Engineer to Owner and Contractor. In the event that the field service time required by this section should not be sufficient to properly place the equipment into operation, additional time shall be purchased by Contractor to correct deficiencies in installation, equipment, or material without additional cost to Owner.

1.05 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT

A. All equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

B. The contractor shall be responsible for unloading of the machinery and shall have equipment on-site available at the time of delivery permitting proper hoisting of the equipment.

1.06 ENGINEER'S PRE-APPROVAL OF ALTERNATE EQUIPMENT

A. Manufacturer of alternate equipment shall submit a pre-approval package to engineer at least two (2) weeks prior to bid date. Alternate manufacturer shall submit the following information and supporting documentation:

1. A complete set of drawings, specifications, catalog cut-sheets, and detailed descriptive material. Drawings shall show all relevant details of the unit. This information shall identify all technical and performance requirements stipulated on the drawings and in the specification. If the proposed equipment does not meet these specifications, any deviation from the specification must be expressly noted. All deviations shall be listed on a single document.

2. Detailed installation drawings illustrating how the proposed screen fits in the channel and where the proposed wash press will be installed. The drawings shall include plan, elevation, and sectional views of the installation. Drawings shall include details of the seal between the screen and the channel, and details of the anchor bolt locations.

3. Hydraulic performance data showing the relationship of head loss versus the full range of downstream liquid depths for the maximum clean water flow, the maximum flow, the average flow, and 33% of the average flow as noted in paragraph 2.02.A. Data based upon other manufacturer's data will not be accepted.

4. Motor characteristics and performance information. Vendor data shall be furnished to confirm the torque and thrust rating of the drive.

5. Complete reference list of all installations of same and similar equipment including contact names and phone numbers, showing at least 15 installations of the same type and size as specified.

6. Complete bill of materials for all equipment, showing dimensions and materials of construction of all components.

7. Certification by the manufacturer that all stainless steel equipment will be manufactured in a stainless steel only factory.

8. Certification that the entire equipment will be passivated by submersion in an acid bath as specified in chapter 2.03.

9. A copy of documents proving certification of the Manufacturer’s Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

10. Details of the control and instrumentation system including wiring diagrams.

11. Information on equipment field erection requirements including total weight of assembled components and weight of each sub-assembly.

12. List of recommended spare parts.

13. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy-out items.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Step Screen Vertical Model SSV 7300/676/6 from Huber Technology, Inc.

B. Step Screen from pre-approved alternate manufacturer(s), as per chapter 1.06. Alternates shall not be acceptable unless pre-approved.

2.02 PERFORMANCE REQUIREMENTS

A. Step Screen shall be capable of processing a peak flow of 5.3 Million Gallons per Day (MGD) of municipal wastewater with no less than 1 ft of freeboard when installed in a 3' - 0" wide channel. Effective screen area shall have a minimum of 75% free open-area for water flow. Open space between the screening blades shall be 1/4" (6mm). Step screen shall lift and discharge screenings at an elevation of 23'-5" above the bottom of the channel onto a discharge chute without use of brushes or spray washers. The discharge chute shall direct the screenings into the hopper of a screenings washer. Base of the screenings washer shall be mounted at a distance of no more than 17' above channel bottom.

B. Maximum upstream water level shall not exceed 36.0 inches above the channel bottom. Step screen shall be capable of processing the peak flow without exceeding the maximum upstream water level based on a 35% reduction of the screen's free open-area.

C. Downstream water level at peak flow will be approximately 24.0 inches above the channel bottom.

2.03 STEP SCREEN DESIGN SPECIFICATIONS

A. MATERIALS

1. Unless otherwise specified in these specifications, the entire equipment shall be manufactured from AISI 304L austenitic stainless steel shapes (rods, angles, and channels), pipes, and sheets. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation according to the O&M manual.

2. The entire equipment shall be manufactured in a stainless steel only factory to prevent contamination of the stainless steel with foreign debris and contaminants.

3. The equipment, after its fabrication, shall undergo a passivation (pickling) process to ensure maximum resistance to corrosion. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the

equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Submergence insures complete coverage. Spray on chemical treatments and glass bead blasting are specifically not acceptable due to their inability to provide complete and uniform corrosion protection.

B. FRAME OF STEP SCREEN

1. Frame shall be fabricated from 0.2" (5 mm) thick AISI 304L stainless steel. The frame shall accommodate fixed step blade packages, blade cross pieces, slewing bracket unit, eccentrics, and drive unit including gear, shaft, and motor.

2. Frame shall be accurately set into position in the channel and shall be capable of supporting the entire screening assembly when suspended from the pivot shaft attached to the support legs. The screen shall be installed with an angle of 75º from the horizontal. The frame shall be sealed to the channel walls with rubber seals.

3. Frame sides shall be fully welded to a 0.2" (5 mm) thick base plate, stationary 0.16" (4 mm) thick step blade cross member brackets and a 0.2" (5 mm) thick drive console. The drive console shall be designed to accommodate eight (8) adjusting bolts. Four (4) adjustment bolts shall be parallel to the screen angle and four (4) shall be perpendicular to the screen angle. The parallel bolts shall adjust the horizontal position of the moveable step blades. The perpendicular bolts shall adjust the vertical position of the moveable step blades

4. The frame sides shall form the supports for cover panels at the sides, the front, and the back of the screen.

C. STEP SCREEN BLADES

1. Moveable step blades shall be cut from 1/12" (2 mm) thick cold-rolled stainless steel sheets. The front-face of the step blade shall have a curved, hook-like shape thus preventing screenings from rolling or falling down from the steps. The steps shall have a horizontal length of 2" (50 mm) and a vertical height of 4-1/8" (105 mm) from step to step. The rear-face of the moveable step blade shall have a series of saw-tooth patterns cut into the straight edge of the step blade to slice through any debris that may accumulate on the cross member supports for the stationary step blades. Each saw-tooth pattern shall consist of ten (10) angular cuts in succession, resulting in a 7-7/8" (200 mm) long serrated edge along the rear-face of the step blade. Each cut shall consist of a 13/16" (20 mm) straight length angled 14 degrees off the rear step blade straight edge followed by a 1/5" (5 mm) cut perpendicular to the straight edge. The moveable step blades shall be mounted in a series of cross member brackets anchored to the moveable side plate.

2. Stationary step blades shall be manufactured from 1/12" (2 mm) thick cold-rolled stainless steel sheets. The stationary step blades shall have exactly the same step shape as those of the moveable step blades. The stationary step blades shall be mounted in a series of cross member brackets anchored to the step screen frame.

3. The effective screening area of the step screen shall be produced by alternating stationary step blades with moveable step blades and spacing the step blades 1/4" (6mm) apart. The open space between the lamina is maintained by 3 inch long HDPE spacer inserts mounted along the length of the moveable step blades at a distance not less than 2 ft apart. The resulting effective screening area shall have a minimum of 75% free open-area.

4. The movable step blades lift the screenings to the next higher stationary step with each rotation cycle of the gear motor. The number of rotation cycles performed in each operating cycle is dependent upon the hydraulic conditions in the channel. After completion of an operating cycle, the step blades shall come to rest in the home position such that the horizontal surface of the step blades are aligned across the width of the channel. A proximity sensor shall send a signal to the PLC when the moveable step blades are in their home position causing the gear motor to stop and hold the step blades in alignment.

5. The screen shall utilize two sets of step blades consisting of upper and lower packages. The upper blade package shall consist of 2mm thick moveable stainless steel blades and 6mm thick fixed Polypropylene blades to prevent debris falling into the channel prior to discharge unless all stainless steel upper lamina are required. The resulting tolerance between the plastic jacket and the adjacent stationary step blade shall be 0.04" (1 mm).

D. BOTTOM STEP FACE BLADE AND FLUSHING PIPE

1. Step screen shall be designed with a blind face plate as the bottom step to prevent grit deposits from accumulating below the step blades. The blind plate shall be manufactured from AISI 304L stainless steel plate 1/12" (2 mm) thick and shall be approximately 10" (250 mm) tall covering the width of the effective screening area. The base of the face plate shall bolt on to the screen sole plate. The top of the face plate shall bolt on to a 5/32" (4 mm) thick cross member support comb for the stationary step blades. A lower grit flap or movable plates are not acceptable.

2. A 1-1/4" diameter stainless steel flushing pipe shall be mounted parallel to the back of the face plate along the width of the channel to prevent heavy material from depositing below the step blades. The flushing pipe shall have 1/2" diameter perforations every 8 inches. The flushing pipe will be fed with non-potable plant effluent through a 1-1/4" stainless steel pipe. The flushing pipe shall be fitted with a 1-1/4" diameter solenoid valve controlling the feed water to the flushing pipe. Screens with effective screening areas greater than 4' – 4" shall be equipped with dual flushing pipes and dual feed water connections.

E. HOME-POSITION PROXIMITY SENSOR

1 Home-position proximity sensor shall send a signal to the PLC that shall cause the gear motor to stop the rotation of the moveable step blade package, when it is aligned with the stationary step blade package. The signal shall be generated when the metal flag attached to the eccentrically rotated block passes the frame mounted sensor.

2 Mounting mechanism of the sensor shall be adjustable to enable the moveable step screen package to be stopped in the proper location.

3 The proximity sensor shall be an inductive proximity sensor. The sensing distance of this sensor shall be 5/64" (2 mm).

F. LINKAGE SYSTEM

1. The step screen shall be designed with a linkage system on each side of the unit that transfers the rotation of the gear motor to the moveable step blade package. Each linkage system shall consist of an eccentrically rotated rectangular eccentric block, a flange bearing, moveable side plate, slewing bracket, linkage arms, and bushings. Chain or cable drives are not acceptable.

2. The rectangular eccentric block shall be made of high-tension steel and be approximately 6" long by 3-1/2" high by 2" thick with two (2) 2" diameter clamping connections and associated keyways bored through the block. One connection shall be clamped to the drive shaft of the gear motor, thereby causing the rectangular block to eccentrically rotate around the drive shaft. The other connection shall be clamped to an eccentric crank shaft to convert circular motion to elliptical motion. The eccentric stub shaft on the opposite side of the crank connects to the moveable side plate through the flange bearing.

3. The moveable side plate shall carry the step support brackets that secure the moveable step blades. The elliptical path of motion that the moveable side plates follow shall be controlled and stabilized by linkage arms and lateral linkage rods.

4. Each side of the screen shall be fitted with one (1) set of two (2) upper and two (2) lower linkage arms to connect the moveable side plates to the screen frame through lateral linkage rods. Each end of the linkage arms shall be free to rotate around stainless steel stub shafts. The upper and lower linkage assemblies shall be arranged such that one end of one linkage arm rotates around a stub shaft connected to the frame and the other end rotates around a stub shaft connected to the lateral linkage rod. One end of the other linkage arm shall rotate a stub shaft connected to the lateral linkage rod, and the other end shall rotate around a stub shaft connected to a moveable side plate.

G. GEAR MOTOR DRIVE MECHANISM

1. The drive unit shall be a gear motor rated for continuous duty and shall be selected to match the requirements of the particular screen. The drive motor shall be a 3 HP unit designed for application in a Class 1, Division 2 area. The motor shall be a constant speed unit rotating at 1680 rpm, and shall be powered by 230/460 VAC, 60 Hz, 3 phase power.

2. The drive unit shall be direct coupled to the screen drive shaft through the gear box. The gear box housing shall be constructed from ASTM A-48, Class 30 cast iron. The drive unit shall be sealed from the screenings transport area with a stainless steel plate, which is welded to the frame and forms the drive console.

3. The screen shall be equipped with electronic overload protection by one (1) true-power monitors to stop the screen and initiate an alarm in the event of overload. The true-power monitor shall monitor both the upstroke and the down-stroke of the screen. Shear pins for overload protection are not acceptable.

H. COVERS

1. The step screen shall include AISI 304L stainless steel covers for odor control and general plant safety. The covers shall extend from the deck level to the top of the screen. The covers on the front of the screen shall be easily removable and shall include a keyed locking mechanism. The covers on the sides and the back of the screen shall be fastened in place by screws.

2.04 CONTROLS DESIGN SPECIFICATIONS

A. CONTROL PANEL

1. The controls shall be incorporated into a single control panel. The enclosure shall be NEMA 4X, stainless steel 304 with continuous hinge and lockable door latch. The control panel will be located outdoors and as such should be equipped with an inner door where all lights, switches, disconnect and touch screen shall be mounted.

2. Enclosure shall provide:
   a. Disconnect, circuit breaker, pad lockable
   b. IEC type motor starters with Circuit Breaker Branch Circuit Protection
   c. Soft starter for screen drive
   d. Control panel shall include one (1) Power Monitoring Relay to detect over-current power consumption by the step screen motor. The power monitor shall measure the input power and will provide a discrete output that can be used to stop the operation of the unit in the event of a jam.
   e. Control power transformer, single phase, 480 – 120 V AC with branch circuit fuses
   f. Transient voltage surge suppressor TVSS, 120 V AC single phase

g. Programmable controller: Allen Bradley Micrologix 1400
h. Operator interface: Allen Bradley PanelView C400
i. Intrinsically Safe Circuits for proximity switches
j. Terminal Blocks
k. Remote dry contacts: remote start/failure indication/indicating screen is running
l. Failures indicated by text messages which get displayed at operator interface
m. UL labeled.

B. Inner Door mounted equipment:
1. Indicator lights:
a. Power on (white)
b. Screen drive running (red)
c. Screen fault (amber)
d. Screen torque fault (amber)

2. E-stop push button

3. Selector switch:
a. Screen drive: Hand – OFF – Automatic

4. System Reset push button

C. Sequence of operation

1. Screen is operated based on the differential level measurement (see paragraph C). The screen starts when the differential level exceeds the start set point. The screen will continue to run until the level drops below the start level. The screen will stop after an adjustable number of steps.

2. Operation based on timer only is not acceptable.

3. The set points are adjustable at the HMI (operator interface).

D. Ultrasonic level monitor

1. In automatic mode, the step screen shall operate based on the water level differential from upstream to downstream of the screen. Ultrasonic level monitors shall be installed upstream and downstream of the step screen. The ultrasonic level monitor shall be a Milltronics HydroRanger, or approved equal.

PART 3: SPARE PARTS

The following spare parts shall be included and supplied together with the equipment:

a) Five (5) lower moveable blades
b) Five (5) lower fixed blades

c) Fifty (50) plastic lamina spacers
d) Three (3) flange bearings

PART 4: EXECUTION

4.01 INSTALLATION

A. Contractor shall verify all dimensions in the field to ensure compliance of equipment dimensions with the drawings. Contractor shall notify Engineer of significant deviations.

B. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. Manufacturer shall supply anchor bolts for the equipment. Contractors shall install the anchor bolts in accordance with the manufacturer's recommendations

C. Supplier shall furnish the services of a factory-trained Service Engineer for one trip including three (3) days to inspect the installation, observe start up, and provide operator training.

1. Equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the Service Engineer present.

2. The Service Engineer shall make all necessary adjustments and settings to the controls. In particular, Service Engineer shall verify the measurement relay setting and the initial water level differential setting for the step screen.

3. The Service Engineer shall demonstrate proper and sequential operation of step screen. The step screen shall operate automatically based on the water level differential.

END OF SECTION

SECTION 11331
SCREENINGS WASHER

PART 1 - GENERAL

1.01 SCOPE

A. Contractor shall furnish, install and place into satisfactory operating condition one (1) screenings wash and press (WAP) for washing, dewatering and compacting, and conveying screenings material from a screen and discharging them into screening bags (bagger optional); as shown on the drawings and described in the specifications.

B. It is the intent of these specifications that all equipment called for under this section shall be supplied by a single manufacturer.

1.02 REFERENCES

A. American Society for Testing and Materials (ASTM) Publications:

3. Section A322: Carbon and Alloy Steel Bar Specifications.
4. Section A507-10: Standard Specification for Drawing Alloy Steel, Sheet and Strip, Hot-Rolled and Cold Rolled

B. Anti-Friction Bearing Manufacturers Association (AFBMA) Publications:

1. Standard 9-90 Load Ratings and Fatigue Life for Ball Bearings.

2. Standard 11-90 Load Ratings and Fatigue Life for Roller Bearings.

C. American Institute of Steel Construction (AISC) Publications

D. American Welding Society (AWS) Publications

E. American Structures Painting Council (ASPC) Publications

1.03 SUBMITTALS

The following information shall be submitted to the engineer. In accordance with Section 01300, copies of all materials required to establish compliance with this Section. Submittals shall include the following:

A. Product Data: Include the following:

1. Descriptive literature, brochures, catalogs, cut-sheets and other detailed descriptive material of the equipment.

2. Motor characteristics and performance information.

3. Gear reducer data including service factor, efficiency, torque rating, and materials.

4. Parts list including a list of recommended spare parts.

B. Shop Drawings: Include the following:

1. Manufacturer's installation drawings.

2. Wiring and schematic diagrams.

C. Operations and maintenance manual: See Section 01300.

D. Detailed installation instructions, with clear step-by-step points on the correct mechanical and electrical installation procedures.

E. Equipment weights and lifting points.

F. Recommendations for short and long term storage.

G. A copy of the manufacturer's warranty

H. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

I. Failure to include all drawings applicable to the equipment specified in this section will result in rejection of the entire submittal with no further review.

1.04 QUALITY ASSURANCE

A. To ensure quality, conformance, and reliability with regard to the manufacturing and production of the equipment, the manufacturer shall meet all requirements listed hereafter:

B. Manufacturer shall have a minimum of twenty (20) years experience producing equipment substantially similar to that required and shall be able to submit documentation of at least fifteen (15) independent installations using the same type of equipment as detailed below. Each installation must have been in satisfactory operation for at least five (5) years.

C. The Contract Documents represent the minimum acceptable standards for the wash and press for this project. All equipment shall conform fully in every respect to the requirements of the respective parts and sections of the drawings and specifications. The

entire unit shall be modified, redesigned, furnished with special features or accessories, made of materials or provided with finishes as may be necessary to conform to the quality mandated by the technical and performance requirements of this specification.

D. The entire unit shall be manufactured from AISI 304L stainless steel shapes. All components made of stainless steel shall be passivated by full submergence in a pickling bath for perfect surface finishing. No stainless steel components may be fabricated or assembled in a factory where carbon steel products are also fabricated, in order to prevent contamination by rust.

E. Electric motors, gear reducers, and other self-contained or enclosed components shall have an acrylic enamel finish.

F. All stainless steel parts of the unit shall be fully submerged into a pickling bath for at least 8 hours to remove welding spots and to protect the stainless steel against corrosion. Glass bead blast or chemically treated stainless steel shall not be allowed.

G. Fabrication shall be done in compliance with all applicable ASTM standards or equivalent international standards.

H. All welding in the factory shall use shielded arc, inert gas, MIG or TIG method. Filler wire shall be added to all welds to provide for a cross section equal to or greater than the parent metal. Butt welds shall fully penetrate to the interior surface and gas shielding to interior and exterior of the joint shall be provided.

I. Bolts, nuts and washers shall be selected from AISI 304L or 316L stainless steel such that they are anti-seizing.

J. Manufacturer shall have established an ISO 9001 certified quality management system. Equipment suppliers not utilizing ISO 9001 facilities shall not be considered or approved for this project. Equipment supplier shall provide evidence of certification before being named as an acceptable manufacturer.

K. Manufacturer shall have established an ISO 14001 certified environmental protection management system designed to monitor and help minimize the harmful effects on the environment caused by its manufacturing processes. Equipment suppliers not utilizing ISO 14001 facilities shall not be considered or approved for this project. Equipment supplier shall provide evidence of certification before being named as an acceptable manufacturer.

L. All welding is performed in accordance with American Welding Society (AWS) D1.1 Structural Welding Code, or equivalent.

M. Manufacturer shall provide wash press, motors, gear reducers, controls, control panels, and lifting attachments as a complete integrated package to ensure proper coordination,

compatibility, and operation of the system. The manufacturer shall test-run the fully assembled machine in his factory before shipment.

N. Manufacturer shall provide services by a factory-trained Service Engineer, specifically trained on the type of equipment specified. The Service Engineer requirements include, but are not limited to the following:

1. The Service Engineer shall be present during initial energizing of equipment to determine directional testing as described in Section 4.03 C (Installation).

2. The Service Engineer shall inspect and verify location of anchor bolts, placement, leveling, alignment and field erection of equipment, as well as control panel operation and electrical connections.

3. The Service Engineer shall provide classroom and/or field training on the Operation and Maintenance of the equipment to operator personnel. These instructions may include the use of slides, videos, literature, and/or oral presentations.

4. Manufacturer shall state field service rates for a Service Engineer to Owner and Contractor. In the event that the field service time required by this section should not be sufficient to properly place the equipment into operation, and the requirement for additional time is beyond the manufacturer's responsibility, additional time shall be purchased by Contractor to correct deficiencies in installation, equipment, or material without additional cost to Owner.

1.05 ENGINEER'S PRE-APPROVAL OF ALTERNATE EQUIPMENT

A. Manufacturer of alternate equipment shall submit a pre-approval package to Engineer at least two (2) weeks prior to bid date. Alternate manufacturer shall submit the following information and supporting documentation:

1. A complete set of drawings, specifications, catalog cut-sheets, and detailed descriptive material. Drawings shall show all relevant details of the unit. This information shall identify all technical and performance requirements stipulated on the drawings and in the specification. If the proposed equipment does not meet these specifications, any deviation from the specification must be expressly noted. All deviations shall be listed on a single document.

2. Detailed installation drawings illustrating how the proposed screenings wash and press will fit in the installation location and will be installed. The drawings shall include plan, elevation, and sectional views of the installation. Drawings shall include details of the seal between the equipment feeding the equipment and the wash and press inlet hopper, and details of the anchor bolt locations.

3. Motor characteristics and performance information. Vendor data shall be furnished to confirm the torque and thrust rating of the drive.

4. Complete reference list of all installations of same and similar equipment including contact names and phone numbers, showing at least 15 installations of the same type and size as specified.

5. Complete bill of materials for all equipment, showing dimensions and materials of construction of all components.

6. Certification by the manufacturer that all stainless steel equipment will be manufactured in a stainless steel only factory.

7. Certification that the entire equipment will be passivated by submersion in an acid bath as specified in chapter 1.04.

8. A copy of documents proving certification of the Manufacturer's Quality Management System according to ISO 9001 and Environmental Protection Management System according to ISO 14001.

9. Details of the control and instrumentation system including wiring diagrams.

10. Information on equipment field erection requirements including total weight of assembled components and weight of each sub-assembly.

11. List of recommended spare parts.

12. A maintenance schedule showing the required maintenance, frequency of maintenance, lubricants and other items required at each regular preventative maintenance period, including all buy-out items.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Base Bid: Rotamat Wash and Press, WAP Size 2 from Huber Technology, Inc.

B. Other pre-submitted and pre-approved Deductive Alternates.

C. Equipment of all manufacturers must be in accordance with these specifications and plans. Being named as a manufacturer does not eliminate their responsibility of providing equipment in compliance with the following specification section. Any deviations without sufficient evidence proving equal or superior quality shall be rejected without further review or comment.

2.02 PERFORMANCE REQUIREMENTS

A. The Wash and Press (WAP) screenings washer shall be capable of processing a maximum of 70 ft^3/hr of screenings. The dewatered screenings shall contain less than 65 % moisture content during normal operating conditions (optimal screenings throughput of 35-53 ft^3/hr). Dewatered screenings shall be discharged at a height of 28' above the base of the channel floor.

B. The equipment specified herein shall be standard equipment manufactured for use in a municipal wastewater treatment plant, specifically to reduce and separate fecal matter from raw sewage screenings.

C. The screening equipment shall produce dewatered screenings capable of passing the EPA Paint Filter Test as described in method 9095 of EPA Publication SW-486.

D. To minimize odors and nuisance, the conveyance, dewatering and compaction zones shall be completely enclosed.

E. The spray wash system shall be enclosed such that spray water, aerosols or leakage do not contaminate the operating floor.

F. The control system shall be designed such that the cleaning characteristics of the wash and press system can be changed via the programmable controller. Systems which do not offer this feature will not be acceptable for this project.

G. MATERIALS

1. Unless otherwise specified in these specifications, the entire equipment shall be manufactured from AISI 304L austenitic stainless steel shapes (rods, angles, and channels), pipes, and sheets. All mechanical parts shall be designed to handle the forces that may be exerted on the unit during fabrication, shipping, erection, and proper operation according to the O&M manual.

2. The entire equipment shall be manufactured in a stainless steel only factory to prevent contamination of the stainless steel with rusty dust.

3. The equipment, after its fabrication, shall undergo a passivation (pickling) process to ensure maximum resistance to corrosion. All stainless steel components and structures shall be submersed in a chemical bath of nitric acid and hydrofluoric acid to remove any residues that may be present on the material as a result of forming, manufacture, or handling. After removal from the pickling bath, the equipment must be washed with a high-pressure wash of cold water to remove any remaining surface debris and promote the formation of an oxidized passive layer which is critical to the long life of the stainless steel. Submergence insures complete coverage. Spray on chemical treatments and glass bead blasting are specifically not acceptable due to their inability to provide complete and uniform corrosion protection.

2.03 PRODUCT DESIGN SPECIFICATIONS

A. SCREENINGS WASHER BODY

1. The WAP 2 screenings washer body shall be fabricated from 1/8” (3 mm) thick AISI 304L stainless steel. The 8-3/8” (213 mm) diameter screenings washer body shall include a nominal 35-3/8” x 9-3/4” (900 mm x 250 mm) trough opening for screenings deposit. A level mounting flange shall be provided around the trough for the transitional hopper that directs the screenings into the trough of the screenings washer. The hopper shall be fabricated from 3/32” (2.5 mm) thick stainless steel.

2. The screenings washer body shall house the shafted screw, and shall include one (1) 3/4" diameter wash water connections in the compaction zone, one (1) 3/8” diameter connection in the screenings trough, and shall include one (1) connection to the drain pan to flush any debris from the drainage pan.

3. The screenings washer body shall include 3/16” (5 mm) diameter perforations spaced 13/32” (10 mm) center-to-center in a vertical alignment in the washing and compaction zones to drain the excess wash water and filtrate water pressed from the screenings to the drain pan.

4. The screenings washer body shall be equipped with not less than six (6) guide bars made of Hardox 400 abrasion resistant plate. The guide bars shall be bolted from the outside of the tube for easy access and removal. The guide bars shall be at least 14-1/2” (370 mm) long and the thickness shall be not less than 1/4” (6mm). Welded guide bars shall be not allowed.

B. SHAFTED SCREW

1. The shafted screw shall transport the screenings from the trough area (washing zone) into the compaction zone and shall force the compacted screenings out the discharge pipe. The shafted screw for the WAP 2 shall be fabricated from 3/16” (5 mm) thick AISI 304L stainless steel.

2. The screw flights shall have a minimum thickness of 3/16” (5 mm) in the trough area, a thickness of 13/32” (10 mm) in the perforated washing zone, and a thickness of 25/32” (20 mm) in the compression zone. The outside diameter of the screw shall be 8-1/16” (205 mm) and shall include a 6” (150 mm) flight pitch in the trough area and washing zone, and a 4” (100 mm) pitch in the compaction zone.

3. Screw flights in the compaction zone shall have a 13/32” (10 mm) thick Hardox 400 abrasion resistant plate welded to the stainless steel flights. The last flight of the screw shall have Tubrodur hard metal seams welded around the external surface of the flight.

4. A stainless steel backed brush with nylon bristles shall be attached to the shafted screw with stainless steel clips and fasteners for the full length of the perforated washing zone.

C. PLANT WATER MANIFOLD

1. The screenings washer shall be equipped with a manifold to provide plant water to the different washing inlet locations. The screenings washer shall be provided with not less than two (2) separate connections for injecting wash water into the screenings and one (1) connection to the drain pan underneath the wash and press body. The unit shall be designed to accept wash water from the facility's non-potable water system, which is sourced from final plant effluent.
2. Wash water connections shall be sized and positioned by the unit manufacturer. Maximum water consumption for the unit shall be 13 gallons per minute. The water pressure range required at the connection to the unit for proper unit operation shall be 30-75 psi.
3. The main wash water supply line to the wash and press unit shall be provided with two (2) 1" diameter Burkert normally-closed solenoid valves with maximum operating pressure of 140psi. The solenoid valves shall be independently controlled by the PLC in the control panel. One solenoid valve shall supply wash water directed against the rotation of the screw flights in the inlet hopper and into the compaction zone of the WAP. The second solenoid valve shall direct wash water to the drain pan beneath the screenings washer body.

D. DRAIN PAN

1. The drain pan shall collect the spent wash water and filtrate water squeezed from the screenings. The drain pan shall be fabricated from 1/8" thick (3 mm) stainless steel and shall connect to the screenings washer body with stainless steel clasps for easy removal.

2. The drain pan shall include one (1) 3/4" threaded inlet connection for wash water from the manifold to flush the trough for cleaning purposes. A 3-1/2" (89 mm) diameter drain connection shall be provided to discharge the drained water back into the channel on the downstream side of the screen.

E. DISHARGE PIPE

1. The wash and press discharge pipe shall be made of stainless steel and shall be connected to the screenings washer body by a 8" (200 mm) diameter flange. The diameter of the straight section of the discharge pipe shall increase in size to ease the transport of the screenings. The diameter of the discharge pipe straight section shall increase from 8-7/16" to 12" (214 mm to 300 mm). The bend fittings on the unit's discharge pipe shall have a radius that is three times (3x) larger than the pipe diameter.

F. GEAR MOTOR DRIVE MECHANISM

1. The drive unit shall be a gear motor rated for continuous duty and shall be selected to match the requirements of the particular wash press. The drive motor shall be a 5 HP, totally enclosed unit designed for application in a Class 1, Division 2 area. The motor shall be a constant speed unit rotating at 1740 rpm, and shall be powered by 230/460 VAC, 60 Hz, 3 phase power.

2. The drive unit shall be direct coupled to the screening wash and press drive shaft through the gear box. The gear box housing shall be constructed from ASTM A-48, Class 30 cast iron.

3. The gear box shall be designed for AGMA Class II, 24 hour duty.

2.04 CONTROL SYSTEM

A. All controls necessary for the fully automatic operation of the Wash and Press (WAP) shall be provided. The controls need to be tied into the screen controls by dry contacts.

B. The controls shall be incorporated into a single control panel. The enclosure shall be NEMA 4X, 304L stainless steel with continuous hinge and lockable door latch.

C. The control panel enclosure shall incorporate the following:

ii. Reversing motor starter, type IEC with Circuit Breaker Branch Circuit Protection
iii. Disconnect, circuit breaker, pad lockable
iv. Current monitoring relay
v. Control power transformer, single phase, 480 – 120 V AC with branch circuit fuses
vi. Transient voltage surge surpressor TVSS, 120 V AC single phase
vii. Programmable controller: Allen Bradley Micrologix 1400
viii. Operator interface: Allen Bradley Panelview C400
ix. UL labeled

D. Local operator station shall be provided and shall be suitable for wall-mounting. The local controls shall be incorporated into a single enclosure. The enclosure shall be NEMA 7, cast aluminum. Door mounted equipment includes the following:

1. Indicator lights for:
   a) Power on (white)
   b) WAP drive running (green)
   c) WAP fault (red)
2. System Reset push button (black)
3. E-stop push button (red)
4. Selector switches:
   a) WAP drive: forward – OFF – reverse
   b) WAP drive: Hand – OFF – Automatic

c) Hopper and Press Zone Wash: Hand – OFF – Automatic
d) Pan Wash: Hand – OFF – Automatic

E. Sequence of operation:

1. Sequence of operation for Wash and Press (WAP) is operated based on the run time of the associated screen. The control panel of the WAP shall receive a signal from screen panel when in operation and accumulate the time the screen is in operation. The WAP starts wash cycle when the accumulated screen operation time reaches the set point.

2. Wash cycle:
   a) Wash water supply is activated: ON/OFF mode with adjustable timers for each operational condition
   b) Drive runs forward also controlled by timers with adjustable ON / OFF sequence
   c) Wash cycle is followed by discharge cycle: screw is running forward for an adjustable time
   d) Pan wash is activated
   e) Wash cycle finished

3. High screening load condition: screen is discharging very high amount of screenings the WAP is switching into discharge mode; this condition is determined by the accumulated run time of the screen.

4. WAP shall have the ability to clear blocking automatically: if current monitoring relay senses high load condition the screw stops and a clearing cycle is initiated: the screw stops immediately and reverses (time is adjustable at operator interface) and starts running forward. The number of attempts to clear the blocking is also adjustable – if screw is not cleared after allowed number of attempts or the overload is sensed during reversing the system stops immediately and an alarm signal is rendered.

PART 3: SPARE PARTS

The following Spare Parts shall be included and supplied together with the equipment:

A. Six (6) Guide bars
B. One (1) Cleaning brush
C. One (1) Solenoid valve rebuild kit

PART 4: EXECUTION

4.01 DELIVERY, STORAGE, AND HANDLING OF EQUIPMENT

A. All equipment shall be shipped and delivered fully assembled, except where partial disassembly is required in order to conform to transportation regulations or for the protection of components.

B. The Contractor shall be responsible for unloading of the machinery and shall have equipment on-site available at the time of delivery permitting proper hoisting of the equipment.

4.02 FIELD PREPARATION AND PAINTING

A. Contractor shall touch-up all shipping damage to the paint and stainless steel as soon as the equipment arrives on the job site.

B. Contractor shall supply paint for field touch-up and field painting.

C. Contractor shall coat all stainless steel bolts and nut threads with a non-seizing compound prior to final assembly.

4.03 INSTALLATION, START-UP AND OPERATOR TRAINING

A. Installation of the equipment shall be in strict accordance with the contract documents and the manufacturer's instructions and shop drawings. The manufacturer shall furnish the anchor bolts for the equipment. It is the Contractors responsibility to install the anchor bolts in accordance with the manufacturer's recommendations.

B. The Contractor shall be responsible to verify the accuracy of all dimensions in the field and to ensure compatibility with the specifications and equipment.

C. The manufacturer shall furnish the services of a factory-trained service technician for one trip including one (1) days to inspect the installation, observe start up, and provide operator training.

1. The equipment shall not be energized, or "bumped" to check the electrical connection for motor rotation without the service technician present.

2. The service technician shall all necessary adjustments and settings to the controls. In particular, the service technician shall verify the measurement relay setting.

3. The Service technician shall demonstrate the proper screenings washer sequence of operation. The screenings washer shall not operate with each screen discharge cycle. The screenings washer shall be set up to initiate after a successive number of screen cycles (accumulated runtime), as determined by the service technician.

End of Section

DIVISION 15

MECHANICAL

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SECTION 15000

PIPING COMPONENTS

PART 1 - GENERAL

1.01 DESCRIPTION

A. The Contractor shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, seismic restraints, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown in the drawings is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The drawings are not pipe construction or fabrication drawings. It is the Contractor's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, and other appurtenances for a complete and functional system.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02646 – Polyvinyl Chloride (PVC) Pipe C-900

B. Section 09800 – Painting and Protective Coatings

D. Section 15041 – Disinfection of Piping

E. Section 15044 – Pressure Testing of Piping.

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. UNIFORM MECHANICAL CODE

B UNIFORM PLUMBING CODE

C. UNIFORM FIRE CODE

D. COMMERCIAL STANDARDS: All equipment, products, and their installation shall be in accordance with the following standards, as applicable, and as indicated in each Section:

1. American Society for Testing and Materials (ASTM)

2. American National Standards Institute (ANSI)

3. American Society of Mechanical Engineers (ASME)

4. American Water Works Association (AWWA)

5. American Welding Society (AWS)

6. American Iron and Steel Institute (AISI)

7. National Fire Protection Association (NFPA)

E. The following standards have been referenced in this Section:

1.	ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch)
2.	ANSI B16.5	Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24
3.	ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in. through 144 in.
5.	ANSI/AWS D1.1	Structural Welding Code – Steel
6.	ASTM A 307	Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
7.	ASTM A 325	Specifications for High-Strength Bolts for Structural Steel Joints
8.	ASTM A 563	Specification for Carbon and Alloy Steel Nuts
9.	ASTM D 2000	Classification System for Rubber Products in Automotive Applications

1.04 CONTRACTOR SUBMITTALS

A. The Contractor shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems for review by the Engineer in accordance with the submittal requirements specified in the General Conditions, and as indicated in the individual piping sections. The shop drawings shall include dimensions and details on pipe joints, fitting specials, harnessed joints, valves, and appurtenances, and shall include design calculations and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

B. The Contractor shall submit information containing the following:

1. Manufacturer's product data.

2. Manufacturer's installation instructions.

3. Manufacturer's certification of compliance.

4. Statement from the pipe fabricator certifying that all pipe will be fabricated subject to a Quality Control Program.

5. Outline of Quality Control Program.

1.05 QUALITY ASSURANCE

A. INSPECTION: All pipe shall be subject to inspection at the place of manufacture. The Contractor shall notify the Engineer in writing of the date for the start of each phase of pipe production and the dates for the proof of design tests. The notification shall be given at least 14 days prior to the start of the pipe manufacture. During the manufacture of the pipe, the Engineer shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. TESTS: Except where otherwise indicated, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable specifications and standards. Welds shall be tested as indicated. The Contractor shall perform all tests at no additional cost to the Owner. Copies of all test reports shall be furnished to the Engineer.

C. WELDING REQUIREMENTS: All welding procedures used to fabricate pipe shall be pre-qualified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. WELDER QUALIFICATIONS: Certified under Section IX, Part A of the ASME Boiler and Pressure Vessel Code or in accordance with AWWA C206, Section 3. Machines and electrodes similar to those used in the Work shall be used in qualification tests. The Contractor shall furnish all material and bear the expense of qualifying welders at no increased cost to the Owner.

1.06 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is advisable in order to obtain perfect pipe joints, supports, or special connections, the Contractor shall furnish such assistance at no additional cost to the Owner.

1.07 MATERIAL DELIVERY, STORAGE, AND PROTECTION

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and shall be stored off the ground to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

PART 2 – MATERIALS

2.01 GENERAL

A. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Divisions 2 and 15 and this Section and as indicated on the Drawings.

B. PRESSURE RATING: All piping systems shall be designed for the maximum expected pressure as defined in Section 15044 – Pressure Testing of Piping, or as indicated on the piping schedule.

2.02 PIPE FLANGES

A. FLANGES: Unless specifically indicated otherwise, all flanges shall conform to either ANSI/AWWA C207 Class E or ANSI B16.5 150-pound class. Where the design pressure is greater than 150 psi as specifically noted, up to a maximum of 275 psi, flanges shall conform to either ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 300-pound class. Flanges shall have flat faces and shall be attached with boltholes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Wax tape wrap all buried flanges and nuts and bolts per Specification Section 09952.

B. BLIND FLANGES: Blind flanges shall be in accordance with ANSI/AWWA C207. A blind flanges for pipe diameters 12-inches and over shall be provided with lifting eyes in form of welded or screwed eye bolts.

C. FLANGE COATING: All machines faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. INSULATING FLANGES: Insulated flanges shall have boltholes ¼-inch diameter.

E. INSULATING FLANGE SETS: Insulating flange sets shall be provided where shown on the Drawings. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2 inches or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2 inches, insulating sleeves and washers shall be two-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.

F. INSULATING FLANGE MANUFACTURERS, OR EQUAL:

1. Calpico, Inc.

2. Farwest

3. PSI Products, Inc., Gardena, California.

G. FLANGE GASKETS: Gaskets shall be full face, 1/8-inch thick, cloth-inserted rubber, with a Shore "A" hardness of 75 to 85. Gaskets shall be suitable for a working pressure of 200 psi at a temperature of 180°F. Gaskets shall have "nominal" pipe size inside diameters not the inside diameters per ANSI B16.21. Products: Garlock Style 19 or Owner approved equal. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets will not be permitted.

2.03 BOLTS AND NUTS FOR STEEL OR DUCTILE IRON FLANGES

A. Bolts and nuts for Class 150 flanges (including AWWA C207, Class E) located indoors, outdoors, above ground, and in vaults and structures shall be carbon steel, ASTM A 307, Grade B.

B. Bolts and nuts for AWWA C207 Class F flanges and ANSI B16.5 and B16.47 Class 300 flanges located indoors, outdoors above ground, and in vaults and structures shall conform to ASTM A 193, Grade B7, with nuts conforming to ASTM A 194, Grade 2H.

C. Bolts and nuts for Class 150 flanges and Class 150 flanges exposed to water or buried shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, for bolts and ASTM A 194, Grade 8M, for nuts.

D. Bolts and nuts for Class 300 flanges shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M, Class 2, for bolts and ASTM A 194, Grade 8M, for nuts.

E. Bolts used in flange insulation kits shall conform to ASTM A 193, Grade B7. Nuts shall conform to ASTM A 194, Grade 2H.

F. Bolts and nuts for above ground installation shall be cadmium-plated.

G. All bolt threads shall be lubricated with graphite and oil. Lubricant for stainless steel bolts and nuts shall be chloride free and shall be TRX-Synlube by Ramco, Anti-Seize by Ramco, Husk-It Husky lube O'Seal, or owner approved equal.

H. Provide washers for each nut. Washers shall be of the same material as the nuts.

2.04 THREADED INSULATING CONNECTIONS

A. GENERAL: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and Cathodic protection are involved.

B. MATERIALS: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other nonconductive materials, and shall have ratings and properties to suit the service and loading conditions.

C. MANUFACTURERS: Isojoint or approved equal.

2.05 VICTAULIC COUPLINGS

A. COUPLINGS FOR GROOVED AND SHOULDERED JOINTS: Couplings shall be cast of ductile iron conforming to ASTM A536 with synthetic rubber gasket. Nuts and bolts shall be in accordance with ASTM A 183.

B. Couplings for pipe smaller than 24-inches shall be flexible type, square cut groove, such as Victaulic Style 77, Gustin-Bacon Figure 100, or equal. Use Victaulic Style 44, or equal, couplings with Type "D" collars for pipe 24-inches and larger.

C. The grooves and shoulders for pipe shall conform to AWWA C606, latest revision.

D. All rings for shouldered joints shall be provided by the coupling manufacturer.

2.06 FLANGED COUPLING ADAPTERS

A. Flanged coupling adapters shall conform to AWWA C100-541. Bodies shall be of ASTM Class 30 cast iron (30,000 psi minimum tensile strength). Bolts and nuts shall be composed of T-316 stainless steel. Flanged coupling adapters shall be Dresser Style 127 or Owner approved equal. Flange ends shall match the flange of the connecting pipe. Adapters shall be fusion bonded epoxy lined. Wax tape wrap all buried flanged coupling adapters and nuts and bolts per Specification Section 09952.

2.07 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.1.

2.08 LINK SEALS

A. Contractor shall furnish and install complete link seal assemblies of size and location as shown on the drawings. Link Seal Assemblies shall be as follows:

1. Wall opening sizes (i.e. cored hole) shall be selected according to manufactured recommendations based on most recent Link Seal catalog or approved equal.

2. Calculations shall be provided to determine sufficient quantity and type of Link Seal are provided to effectively provide a hydrostatic seal.

3. Each individual link shall be clearly and permanently shown with the name of the manufacturer and model number.

B. Link Seals shall be modular, mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the wall opening. The elastomeric element shall be sized and selected per manufacturer's recommendations and have the following properties as designated by ASTM: EPDM = ASTM D2000 M3 BA510.

C. References to installation guidelines shall be latest published edition of Link Seal Selection Guide for the service intended.

D. APPROVED MANUFACTURER'S:

1. Thunderline/Link Seal, or Owner approved equal.

2.09 Y-STRAINERS

A. Unless otherwise indicated, y-type strainers shall be sized and installed as indicated in the Contract Drawings and shall conform to the following requirements:;

1. Cast iron bodies

2. NPT screwed ends

3. Type 304 stainless steel screen with 1/32 inch perforations

4. Steel screen drain plug

5. Unit shall be suitable for minimum pressure of 250 psi

B. APPROVED MANUFACTURERS:

1. Fisher Controls Company, Type 260C, or Owner approved equal

2.10 PIPE UNIONS

A. Screw unions may be employed on pipelines 2-1/2 inches in diameter and smaller. Pipes and fittings made of non-ferrous metals shall be isolated from ferrous metals by nylon insulating pipe bushings, unions or couplings manufactured by Smith-Blair, Pipe Seal and Insulator Co. or approved equal.

2.11 RED BRASS PIPE

A. Brass pipe shall conform to the requirements of the "Specifications for Seamless Red Brass Pipe, Standard Sizes" (ASTM B43).

PART 3 – EXECUTION

3.01 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of Divisions 2 and 15. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.

B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.

3.02 INSTALLING COUPLINGS OR ADAPTERS

A. Clean oil, grease, scale, and dirt from pipe ends. Repair any damage or holidays in the shop applied coating before installing couplings or adapters. Clean gaskets in flexible pipe couplings, transition couplings, and flanged coupling adapters before installing.

B. Clean sleeve bolts and nuts by wire brushing before installing in end rings. Lubricate threads of bolts and nuts with oil or graphite prior to installation. Tighten nuts uniformly and in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench.

C. If couplings or adapters leak under pressure testing, loosen or remove the nuts and sleeve bolts, reset or replace the gaskets, reinstall or retighten the bolts and nuts, and retest the coupling or adapter. Couplings and adapters shall be watertight.

D. After testing, wrap sleeve bolts and nuts of buried couplings or adapters with wax tape coating per Specification section 09868.

E. Wrap buried couplings and adapters with polyethylene material per Specification Section 09867.

3.03 INSTALLING FLANGED JOINTS

A. Set pipe with the flange bolt holes straddling the pipe horizontal and vertical centerline. Install pipe without springing, forcing, or stressing the pipe or any adjacent connecting valves or equipment. Before bolting up, align flange faces to the design plane within 1/16-inch per foot measured across any diameter. Align flange bolt holes within 1/8-inch maximum offset.

B. Clean bolts, nuts, washers and flange faces by wire brushing before installing gasket and adjoining flange. Inspect gasket seating surfaces, gasket, each bolt, nut, washer, and facing on which the nuts will rotate. Replace any damaged item.

C. Lubricate threads of carbon steel bolts and nuts with oil and graphite prior to installation. Assemble all bolts, nuts, and washers in the flange, then tighten nuts in a progressive diametrically opposite sequence, and torque with a calibrated torque wrench. All clamping torque shall be applied to the nuts only.

D. Bolt lengths shall extend completely through their nuts. Any which fail to do so shall be considered acceptably engaged if the lack of complete engagement is not more than one thread.

E. Do not use more than one gasket between contact faces in assembling a flanged joint.

F. Place washers under all nuts. Place washers under bolt heads where the flanges have been fusion bonded epoxy coated. Do not damage coated surfaces during installation.

G. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight. Replace galled, cracked, or distorted bolts and nuts.

H. After testing, coat exposed surfaces of bolts, nuts, and washers to be buried with primer for wax tape coating per Specification Section 09952.

3.03 PAINTING AND COATING

Coat flexible pipe couplings, transition couplings, flanged coupling adapters and joint harnesses located aboveground, or in vaults and structures, the same as the adjacent pipes and per Specification Division 9. Do not apply flame spray coating to fusion-bonded

epoxy coated couplings. Apply finish coats in the field. Color of finish coat shall match color of the adjacent piping.

3.04 PRESSURE TESTING

Test coupling and adapters at the same time that the connecting pipelines are pressure tested. See Specification Section 15044 for pressure testing requirements. Repair leaks in piping and retest.

END OF SECTION 15000

SECTION 15044
PRESSURE TESTING OF PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies the hydrostatic and leakage testing of pressure piping.

A. RELATED WORK NOT INCLUDED IN THIS SECTION:
   1. Process Piping and Appurtenances, Section 15060.

1.02 SUBMITTALS

A. Submit Shop Drawings in accordance with Section 01340.

B. Submit test bulkhead locations and design calculations, pipe attachment details such as temporary vents, valves and drains, and methods to prevent excessive pipe wall stresses.

C. Submit six copies of the test records to the Engineer upon completion of the testing.

1.03 TESTING RECORDS

A. Provide records of each piping installation during the testing. Test records shall include:
   1. Date of test.
   2. Identification of pipeline, or pipeline section, tested or retested.
   3. Identification of pipeline material.
   4. Identification of pipe specification.
   5. Test fluid.
   6. Test pressure.
   7. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
   8. Certification by Contractor that the leakage rate measured conformed to the specifications.
   9. Test duration
   10. Allowable losses.
   11. Actual losses.

PART 2 - MATERIALS

2.01 VENTS AND DRAINS FOR ABOVE GROUND PIPING

Install vents on the high points of above ground piping, whether shown on the Plans or not. Install drains on low points of above ground piping, whether shown on the Plans or not. Provide a valve at each vent or drain point. Valves shall be 3/4 inch for piping 3

inches and larger and 1/2 inch for piping smaller than 3 inches. Valves shall be all-bronze ball valves, unless otherwise shown on the Plans.

2.02 MANUAL AIR-RELEASE VALVES FOR BURIED PIPING

Where necessary, provide temporary manual air-release valves for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and after use, seal with a blind flange, pipe cap, or plug and coat equal to the adjacent pipe.

2.03 TEST BULKHEADS

Design and fabricate test bulkheads per Section VIII of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of said code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70 percent of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

2.04 TESTING FLUID

For potable water pipelines, obtain and use only potable water for hydrostatic testing.

2.05 TESTING EQUIPMENT

Provide new, calibrated, 6 inch diameter face pressure gauges and a chart recorder, pipes, bulkheads, pumps, and calibrated meters to perform the hydrostatic testing. Use laboratory calibrated test gauges and meters, which shall be calibrated by a certified laboratory prior to the test. Submit proof of calibration.

PART 3 - EXECUTION

3.01 TESTING PREPARATION

A. Place and anchor pipes before commencing pressure testing.

B. Conduct pressure tests on exposed and above ground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.

C. Conduct pressure tests on buried piping after the trench has been completely backfilled.

D. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. Water shall not be obtained directly through in-line valves---an air gap or approved RP backflow device must be utilized. After the test has been completed and demonstrated to comply with the specifications, disconnect and remove temporary piping.

E. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing.

3.02 CLEANING

A. In pipelines less than 24 inches in diameter, before conducting hydrostatic tests, flush pipes with water to remove dirt and debris. Maintain a flushing velocity of at least 3 fps for water testing. Flush pipes for the minimum time period as given by the formula below and as required to thoroughly clear the pipeline of dirt and debris.

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)
L = pipe length (feet)

B. In pipes 24 inches or larger in diameter, clear the pipe using high-pressure water jet, sweeping, scrubbing, or equally effective means. All water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

3.03 TESTING AND DISINFECTION SEQUENCE OF POTABLE WATER PIPING

A. Perform required chlorination subsequent to hydrostatic testing, except when pipeline being tested is connected to a potable waterline.

B. Locate and install test bulkheads, valves, connections to existing pipelines, and other appurtenances in a manner to provide an air gap separation between existing potable water pipelines and the pipeline being tested, or provide approved RP backflow device.

3.04 LENGTH OF TEST SECTION FOR BURIED PIPING

The maximum length of the test section for buried pipe is 2,500 feet, or the distance between valves, whichever is greater.

3.05 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

Control maximum rate of filling to prevent water velocity in pipeline from exceeding 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

3.06 HYDROSTATIC TESTING OF ABOVE GROUND OR EXPOSED PIPING

Open vents at high points of the piping system to purge air while the pipe is being filled with water. Venting during system filling may also be provided by temporarily loosening flanges. Subject the piping system to the test pressure specified herein. Maintain the test

pressure for a minimum of 24 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained. Air and vacuum valves shall be in place and working in case of pipe failure during testing.

3.07 HYDROSTATIC TESTING OF BURIED PIPING

A. Where any section of the piping contains concrete thrust blocks or encasement, do not pressure test until at least 7 days after the concrete has been poured. When testing cement mortar lined piping, fill the pipe to be tested with water and allow it to soak for at least 48 hours to absorb water before conducting the pressure test.

B. Apply and maintain the test pressure by means of a hydraulic force pump.

C. Maintain the test pressure for the following duration by restoring the pressure whenever it falls an amount of 5 psi:

Pipe Diameter (inches)	Hours
18 and less	4
20 to 36	6
Greater than 36	8

D. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage rate is defined by the formula:

$$L = \frac{HND(P)^{1/2}}{C}$$

in which:

H = specified test period (hours)
L = allowable leakage (gallons)
N = number of rubber-gasketed joints in the pipe tested
D = diameter of the pipe (inches)
P = specified test pressure (psig)
C = 7,400

1. The allowable leakage for welded steel pipe with fully welded joints shall be zero gallons.
2. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero gallons.

E. Repair and retest any pipes showing leakage rates greater than that allowed in the above criteria.

3.08 TEST PRESSURE

A. GENERAL: The field hydrostatic test pressure in pounds per square inch shall be 150 psi for pressure pipelines. The gravity pipelines shall be tested at 50 psi.

3.09 REPETITION OF TEST

If the actual leakage exceeds the allowable, locate and correct the faulty work and repeat the test at the Contractor's expense. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

3.10 BULKHEAD AND TEST FACILITY REMOVAL

After a satisfactory test, remove test bulkheads and other test facilities, restore the pipe lining and coatings, and fill the pipeline section tested with water and maintain it full until disinfection of pipeline at the completion of the contract. The Contractor shall assume all responsibility for any damage to the pipeline as a result of pressure imposed during the operations of filling the pipeline with water and conducting the tests.

END OF SECTION 15044

SECTION 15045

TESTS FOR LEAKAGE IN SEWERS

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies the leakage testing requirements for sewer gravity mains and force mains. Contractor shall, at his own expense, furnish all tools, equipment, materials and supplies, including all labor required to perform, and successfully pass the specified leakage testing.

1.02 RELATED SECTIONS

A. SHOP DRAWINGS AND SUBMITTALS: Section 01340

B. PROCESS PIPING AND APPURTENANCES: Section 15060

1.03 SUBMITTALS

A. Submit Shop Drawings in accordance with Section 01340.

B. Submit test bulkhead locations and design calculations, pipe attachment details such as temporary vents, valves and drains, and methods to prevent excessive pipe wall stresses.

C. Submit six copies of the test records to the District upon completion of the testing.

1.04 LEAKAGE TESTS

A. GENERAL: All the tests for exfiltration from, and infiltration into the system shall be in accordance with Section 306-1.4 of the "Standard Specifications for Public Works Construction", 2000 Edition, except as modified herein. The method of testing and testing equipment shall be approved by the District.

Prior to testing, all pipelines shall be thoroughly flushed and cleaned using a method approved by the District. All water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

B. TESTING STANDARDS: The standard testing performance requirements are set forth herein. If the leakage or infiltration, as shown by the tests, exceeds the standard set forth in said section, Contractor shall, at no

additional cost to the District, make the necessary repairs by methods approved by the District to correct the deficiencies.

C. SCHEDULING AND COMPLETION OF TESTING: All tests must be completed before the street or trench is resurfaced with permanent pavement replacement, but after complete installation and trench compaction of all facilities within a particular section between manholes or structures.

D. AIR TESTING OF GRAVITY SEWERS: The Contractor shall test all gravity sewers by means of the air test specified herein, unless otherwise directed by the District. The air test shall be in accordance with Section 306-1.4.4 of the Standard Specifications for Public Works Construction, 2000 Edition, except as herein modified.

1. Air shall be introduced into the pipeline until 3-1/2 psi gauge pressure has been reached, at which time the flow of air to the pipe shall be shut off.

2. After the temperature has stabilized, the air pressure shall be permitted to drop and, when the internal pressure has reached 3.0 psi gauge, the time lapse required for the air pressure to drop to 2.0 psi gauge shall be measured.

3. The time lapse (in seconds) required for the air pressure to decrease from 3.0 to 2.0 psi (gauge) shall not be less than that given in the following table:

Sewer Pipe Dia.	Minimum Time Lapse (Seconds)
8"	140
10"	170
12"	200
15"	260
18"	310
21"	360
24"	410
27"	460
30"	510
33"	560
36"	610
39"	660
42"	710

4. If the time lapse exceeds that shown in the table, the pipe shall be presumed to be within acceptable limits; if the time lapse is less,

the Contractor shall make the necessary corrections to reduce the leakage to acceptable limits by repair methods approved by the District.

5. Allowable leakage for HDPE having heat fused joints shall be zero psi pressure drop.

E. WATER INFILTRATION TEST FOR GRAVITY SEWERS: Where ground water conditions are encountered and the water level prior to any pumping or dewatering operations is above the top of the proposed sewer pipe, then the Water Infiltration Test shall be used in lieu of the air test specified in paragraph 1.04D.

1. The Water Infiltration Test shall be in accordance with Section 306-1.4.3 of the Standard Specifications for Public Works Construction, 2000 Edition, except as herein modified.

2. The infiltration shall not exceed 0.0016 gallons per hour per foot of sewer, per inch of pipe diameter. The test shall be run for a minimum period of two (2) hours.

3. If ground water conditions are such that the ground water level is between the flow line of the proposed sewer pipe and the top of the pipe, both the air test and the water infiltration test shall be conducted at no additional cost to the District. In such a case, the section of pipe being tested shall be deemed acceptable only if it passes both the air test and the water infiltration test.

F. WATER PRESSURE TEST FOR FORCE MAINS: All sewer force mains shall be water pressure tested in accordance with Section 306-1.4.5 of "Standard Specifications for Public Works Construction", 2000 Edition.

1. The minimum field hydrostatic test hydraulic grease line (HGL) for the discharge piping and sewer force main at the lift station site shall be about 750 feet, or 75 psi.

2. Allowable leakage for buried piping having threaded, brazed or welded (including solvent welded or heat fused) joints shall be zero gallons.

3. Where any section of the piping contains concrete thrust blocks or encasement, do not pressure test until at least 7 days after the concrete has been poured.

G. CONTRACTOR RESPONSIBILITY: The Contractor shall assume all responsibility for any damage to the pipeline as a result of pressure

imposed during the operations of filling the pipeline with water and conducting the tests.

1.05 TESTING RECORDS

A. GENERAL: Contractor shall provide testing records of each piping installation for each test.

B. TEST RECORD INFORMATION: Test record information shall include:

1. Date of test.

2. Identification of pipeline, or pipeline section, tested or retested.

3. Identification of pipeline material.

4. Test pressure, allowable losses and duration.

5. Test results and actual losses.

6. Leaks identified, types of repairs or corrections made.

7. Certification by Contractor that the leakage rate measured conformed to the specifications.

END OF SECTION 15045

SECTION 15089

NUTS & BOLTS

PART 1 - REQUIREMENT

1.01 BOLTS AND NUTS FOR FLANGED FITTINGS shall have hex heads and lite-pattern hex nuts herein.

A. SUBMERGED OR WET WELL CONDITION: ASTM F593 Stainless Steel Type 316 nuts and bolts.

1. Minimum tensile strength shall be 90,000 psi.

2. Minimum yield strength shall be 50,000 psi.

B. NON-SUBMERGED CONDITION: ASTM A449 (SAE Grade 5) medium carbon steel nuts and bolts.

1. Minimum yield strength shall be 90,000 psi.

2. Minimum yield strength shall be 55,000 psi.

3. Xylan coat (fluoropolyer) all nut and bolt surfaces with Tripac 2000 Blue Coating System or approved equal.

END OF SECTION 15089

SECTION 15100

VALVES

PART 1 - PRODUCTS

1.01 GENERAL

A. Scope: Furnish and install all valves complete and in accordance to the requirements of the Contract Documents.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of valve. Include pressure drop curve or chart for each type and size of valve.

B. Shop Drawings: Submit manufacturer's assembly-type (exploded view) shop drawings for each type of valve, indicating dimensions, weights, materials, and methods of assembly of components.

C. Maintenance Data: Submit maintenance data and spare parts list for each type of valve. Include this data, product data, and shop drawings in maintenance manual, in accordance with requirements of the General Conditions.

1.03 QUALITY ASSURANCE:

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of valves, of types and sizes required, whose products have been in satisfactory use in similar service.

B. Valve Types: Provide valves of same type by same manufacturer.

C. Valve Identification: Provide valves with manufacturer's name (or trademark) and pressure rating clearly marked on valve body.

D. Codes and Standards:

1. MSS Compliance: Mark valves in accordance with MSS-25 "Standard Marking System for Valves, Fittings, Flanges and Unions".
2. ANSI Compliance: For face-to-face and end-to-end dimensions of flanged- or welded-end valve bodies, comply with ANSI B16.10 "Face-to-Face and End-to-End Dimensions of Ferrous Valves".

PART 2 - PRODUCTS

2.01 ECCENTRIC PLUG VALVES

A. All plug valves shall be of the tight-closing, resilient faced plug type and shall be of bi-directional eccentric seating such that the opening movement of the closing member results in the closing member rising off the body seat contact.

B. Valve bodies shall be constructed of cast iron ASTM A-48 Class 40. Flanges shall be faced and drilled in accordance with ANSI B16.1

C. Plug valves shall be furnished with permanently lubricated, sleeve type metallic bearings. Grit excluder seals shall be provided in the upper and lower journals to isolate the bearings.

D. Plug valve shaft seals shall be the self-adjusting type, replaceable without removing the valve bonnet

E. Manual gear actuators shall be totally enclosed worm and gear type permanently lubricated. Above ground valves 6" and larger shall be provided with gear actuators. Buried valves 4" and larger shall be provided with gear actuators.

F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering eccentric plug valves which may be incorporated into the work are:

1. Milken
2. Pratt
3. Dezurik
4. Or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Except as otherwise indicated, comply with the following requirements:

1. Install valves where required for proper operation of piping and equipment, including valves in branch lines where necessary to isolate sections of piping. Locate valves so as to be accessible and so that separate support can be provided when necessary.
2. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane.

B. Insulation: Where insulation is indicated, install extended-stem valves, arranged in proper manner to receive insulation.

C. Selection of Valve Ends (Pipe Connections): Except as otherwise indicated, select and install valves with the following ends or types of pipe/tube connections.

1. Pipe Size 2" and Smaller: One of the following, at Installer's option:
   a. Threaded valves.
   b. Flanged valves.
2. Pipe Size 2-1/2" and Larger:
   a. Flanged valves.
   b. Grooved joint valves.

D. Valve System: Select and install valves with outside screw and yoke stems, except provide inside screw non-rising stem valves where headroom prevents full opening of OS&Y valves.

E. Renewable Seats: Select and install valves with renewable seats, except where otherwise indicated.

3.02 ADJUSTING AND CLEANING

A. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks. Adjust or replace packing to stop leaks, replace valve if leak persists.

B. Valve Identification: Tag each valve in accordance with Division-15 section "Mechanical Identification".

3.03 VALVE INSTALLATION

A. Locate all valves in locations which will allow easy operation and facilitates maintenance.

B. Provide chain operators for any valves located more than 8 feet above finished floor. This means double acting lever handles for quarter turn valves, or chain wheels for multi-turn valves. Arrange valves and set up chain length for proper operation.

END OF SECTION 15100

SECTION 15108

PLUG VALVES

PART 1 - GENERAL

1.01 REQUIREMENT

Plug valves for above grade or buried sewage system service. Under this specification the Contractor shall be required to furnish, deliver, and unload within the time specified in the Special Requirements, the plug valves as specified on the bidding sheets and the Drawings and hereinafter described in these specifications.

1.02 VALVE MANUFACTURER

The name of the manufacturer of the valves to be furnished by the bidder shall be stated on the bidding sheets. Plug valves shall be Pratt Ballcentric plug valves or approved equal as manufactured by Dezurik.

1.03 GUARANTEE

The Contractor shall guarantee all materials and workmanship of items furnished under these specifications to be free from defects for a period of one (1) year after final completion and acceptance of the entire contract work. The Contractor shall, at his own expense, repair or replace all defective materials or workmanship supplied by him found to be deficient with respect to any provisions of this specification.

1.04 SUBMITTALS

Submit detailed shop drawings and description of each size valve including materials and parts list in accordance with Section 01340.

PART 2 - PRODUCT

2.01 VALVE CONSTRUCTION

A. GENERAL:

1. Valves shall be designed for either a minimum working pressure of 150 psi or working pressure of the pipe in which the valve is to be installed, whichever is higher. Pipe schedule is located on the Contract Drawings. Each valve shall be given a hydrostatic and seat test at the minimum working pressure or greater.

2. Port area shall be at least 80 percent of connecting pipe area for valves up to 20 inches in diameter and at least 70 percent of pipe area for valves larger than 20 inches in diameter.

3. Each valve shall have an indicator for the plug position and the direction of normal flow.

B. VALVE BODIES:

1. Shall be of semi-steel (nickel-chrome alloy) or ASTM A126 Class B cast iron.

2. Valve ends shall conform to the joint of the pipeline in which it is being installed.

3. Valves 3 inches and larger shall be of the bolted bonnet construction.

C. VALVE PLUG:

1. Shall make contact with the seat only in the fully closed position.

2. Shall be of semi-steel, ASTM A126 Class B cast iron, ASTM A-48, Class 40 Cast Iron, or ASTM 536 Gr. 65-45-12 Ductile Iron, and with resilient facing. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft.

D. VALVE SEAT:

1. Valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel.

a. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

b. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure.

E. VALVE SEALS:

1. Shall be of the permanently lubricated, multiple v-ring type.

2. Shall be adjustable and repackable without removing the valve from the pipeline.

F. BEARINGS:

1. Bearings shall be metallic sleeve type and shall be of sintered, oil impregnated, permanently lubricated type 316 ASTM A743 Grade CF-8M.

G. OPERATORS:

1. Valves 6 inches and smaller above ground shall be wrench-operated unless otherwise specified.

   a. Furnish a wrench for each valve.

2. Valves 8 inches and larger and buried valves shall be gear-operated unless otherwise specified.

   a. Unless other operators are specified or the valve is buried, each valve shall have hand wheels.

   b. Valves located more than 5 feet above the floor shall have chain wheel operators with chains to within 4 feet of floor and a minimum of 2 feet of chain below the chain wheel centerline. Chains shall be hooked to clips arranged to clear walking aisles.

   c. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for changes in pressure differential or flow direction change.

   d. Valves installed in the ground shall be equipped with valve boxes and extension stems.

H. All exposed nuts, bolts and washers shall be zinc-plated. Internal body and parts of the valve shall be coated with epoxy coating approved by EPA or NSF for contact with potable water.

2.02 SHOP PAINTING AND COATING

A. INTERNAL LINING: All internal ferrous metal parts of plug valve to the fusion bonded epoxy lined with Skotchkote #134 in accordance with Section 09871.

B. EXTERNAL COATING: Valves to be field painted shall be shop primed with primer compatible to the field painting specified in the Section 09871.

PART 3 – EXECUTION

3.01 INSTALLATION

A. GENERAL: Plug valves shall be installed as indicated for the normal direction of flow. All plug valves shall be installed such that the plug is on the topo or side of the valve when in the open position.

B. BURIED SERVICE: For buried service, extension stems shall be provided with position indicators.

3.02 FIELD PAINTING

A. The field painting of all valves shall be in accordance with the painting specified for the pipeline into which the valve is installed.

B. Valves painted with asphalt varnish shall be coated with a minimum of one coat of Inertol "tar stop" or equal or sand-blasted as specified in the Section 09871 before additional coats are applied.

3.03 FIELD TESTING

A. FIELD OPERATION: After installation, the Contractor shall operate all valves to show they operate without binding or strain.

B. DEFICIENCIES: Any deficiencies shall be corrected at the Contractor's expense.

END OF SECTION 15108

SECTION 15110

ALUMINUM SLIDE GATES

PART 1 - GENERAL

1.01 REQUIREMENT

A. Scope: There shall be furnished aluminum slide gates as shown on the drawings. The equipment shall include gates, frames, and gear operators.

B. Acceptable suppliers

1. Golden Harvest
2. Fontaine LTD
3. Rodney Hunt
4. Whipps Inc.
5. Waterman Industries, Inc
6. or equal

C. QUALITY ASSURANCE: The slide gates and operators shall be the product of a manufacturer having a minimum of five (5) years successful experience in the design and production of water control equipment of this type. At the request of the engineer, the manufacturer shall submit evidence of performance on other projects with similar design conditions. Gates shall be Series 900 as manufactured by Whipps, Incorporated, of Athol, Massachusetts or approved equal.

PART 2 - PRODUCTS

1.01 THE REQUIREMENT

A. General Design: All slide gates will have ultra high molecular weight polymer (UHMW) seat seals having an intrinsic viscosity of greater than 14 by test. UHMW seat seals shall be provided on both upstream and downstream faces of the slide and shall be mechanically locked in the gate guides. Each UHMW seat seal will be shaped to provide two bearing surfaces and two sealing edges. The slide will be a tight fit within the UHMW to limit leakage.

B. MATERIALS OF CONSTRUCTION: Aluminum Gates – The aluminum gates shall be ¼ inch minimum thickness extruded (ASTM B-221), cast (Alloy SR-319), or rolled aluminum (ASTM B-209) type 6061-T6. Guides for wall-mounted frames shall be extruded.

C. FRAMES: The wall-mounted gate frames shall be of self-contained design with integral, welded yokes. Guides shall be extruded, one-piece, for the full height of the frame. Frames shall extend above the operating floor to the height shown on the plans. The yoke channels supporting the operator shall be welded to the guides

to provide a one-piece rigid frame. Yoke members shall be spaced such that the operator, stem and slide can be easily removed. The gate invert frame member shall contain a replaceable neoprene seat seal. Invert seals attached to the gate slide will not be acceptable.

D. SLIDES: Gates Slides shall consist of a flat plate, reinforced with welded stiffeners. Stiffeners shall be of type, spacing and number such that, at the design head, bending stress is limited to 1/5 the ultimate strength of the material and deflection is limited to 1/360 of the gate width. Stem connection will be by means of a threaded block, either directly welded to the slide or contained in a pocket designed to distribute operating forces to the upper region of the slide.

E. STEMS: The operating stem shall be sized to safely withstand without buckling or permanent distortion the stresses induced by normal operating forces. The stem shall have a minimum diameter of 1-1/2 and shall be designed to transmit in compression at least stall thrust x 1.3 times the rated output of the electric operator. Stem threads shall be machine-cut, acme type. Stems shall be stainless steel, ASTM A-276 type 304 and shall be one-piece. Clear plastic stem covers shall be provided, properly vented, with indicator strips for field-mounting by the installing contractor.

F. GEARED OPERATORS AND ELECTRIC ACUATOR: Gates which are equipped with electric motor operators and electric actuators will be sized and furnished by gate supplier.

2.02 THE ACTUATOR REQUIREMENT

A. Gear housing will be made of cast aluminum with a bronze alloy worm gear and heat-treated steel spur gear.

B. Electrical compartment covers: Cast Aluminum, 0-ring sealed with nickel-plated carbon steel hardware.

C. Motor: Squirrel cage induction 460 volt 3-phase 60 Hz, 16 minute normal duty. Dynamic Torque is minimal 20% of start torque.

D. Manufacturer: EIM, Auma, Limitorque, Rotorque, or equal.

E. Controls: Local controls including Open, Close, Stop, Local, Remote, and Off.

F. Remote Signals:

1. Position – % OPEN (analog out)
2. Fail
3. Remote signal to open and close (modulate)

G. Operation: In the remote position, gate will receive a 4-20 mA signal to set

position of gate to achieve a predetermined flow rate. Control will be by a remote PLC. In the local position, the gate controlled by the local switches.

END OF SECTION 15110

SECTION 16000 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. It is the intent of this part of the Contract Documents to cover the work and materials necessary for erecting a complete electrical system, tested and ready for continuous use. The system shall be constructed in accordance with the Contract Documents, and Federal, State, and Local codes and regulations.

1.02 RELATED SECTIONS

A. The Contractor shall coordinate the work with other trades, and furnish and install the equipment in accordance with the manufacturers' requirements.

B. The Related Work can be found in other Divisions of these specifications, such as, but not limited to:

Division 0	Bidding Requirements, Contract Forms, and Conditions of the Contract
Division 1	General Requirements
Division 2	Sitework
Division 3	Concrete
Division 9	Finishes
Division 11	Equipment
Division 13	Special Construction
Division 15	Mechanical
Division 17	Instrumentation

1.03 GENERAL PROVISIONS

A. Minimum sizes of equipment, and electrical devices, are indicated but it is not intended to show every offset and fitting, nor every structural or mechanical difficulty that will be encountered during the installation of the work.

B. Work indicated on the Plans is approximately to scale, but actual dimensions and detailed Plans should be followed as closely as field conditions permit. Field verification of scale dimensions on Plans is governed by field conditions. Installation of systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination.

C. Discrepancies indicated on different Plans, between Plans and actual field conditions, or between Plans and Contract Documents shall be promptly brought to the attention of the Engineer for clarification, prior to purchasing and installing equipment.

D. The alignment of equipment and conduit shall be adjusted to accommodate architectural changes, or to avoid work of other trades, without extra expense to the Owner.

E. The Contractor shall furnish and install the parts and pieces necessary to the installation of equipment, in accordance with the best practice of the trade, and in conformance with the requirements of these Contract Documents.

F. Items not specifically mentioned in these Contract Documents, or noted on the Plans, or indicated on reviewed shop drawings, but which are obviously necessary to make a complete working installation, shall be deemed to be included herein.

G. The Contractor shall layout and install electrical work prior to placing floors and walls. Furnish and install sleeves and openings through floors and walls, required for installation

of conduits. Sleeves shall be rigidly supported and suitably packed, or sealed, to prevent ingress of wet concrete. Spacers shall be installed in order to prevent conduit movement. Dimensions indicated for electrical equipment and their installation are restrictive dimensions.

H. The Contractor shall furnish and install inserts and hangers required to support conduits and other electrical equipment. If the inserts, hangers, sleeves, or other mounting hardware are improperly placed, or installed, the Contractor shall do necessary work, at their own expense, to rectify the errors.

I. Electrical equipment shall be capable of operating successfully at full-rated load, without failure, at an ambient air temperature of 40 degrees C, and specifically rated for the altitude indicated on the Plans. Electrical equipment not rated for operation at that temperature shall be provided with air conditioning to meet the manufacturers' operating temperature.

J. If any contradictions, contrasts, nonhomogeneity, or inconsistency appears, the most strict criteria noted and the collective requirements in any and all of the project documents shall apply.

K. The Contractor shall perform necessary saw cutting, core drilling, excavating, removal, shoring, backfilling, and other work required for the proper installation of conduits, whether inside, or outside of the buildings and structures. The Contractor shall repair and patch where demolition has taken place in a manner to match existing original structure.

1.04 REGULATIONS, CODES, AND STANDARDS

A. Electrical work, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the latest published regulations, codes, and standards, of the following:

1. National Electrical Code (NEC)
2. State and local codes
3. Institute of Electrical and Electronic Engineers (IEEE)
4. American National Standards Institute (ANSI)
5. American Society for Testing and Materials (ASTM)
6. Insulated Cable Engineers Association (ICEA)
7. National Electrical Manufacturers Association (NEMA) Standards
8. Federal Occupational Safety and Health Act (OSHA)
9. National Fire Protection Association (NFPA)

B. When applicable, the material used in the performance of the electrical work shall be listed by the Underwriters' Laboratories, Inc. (UL) for the class of service for which they are intended.

1.05 SUBMITTALS

A. It is the obligation of the Contractor to organize their work, so that a complete electrical, instrumentation, and control system for the facility will be provided, and will be supported by accurate shop and record drawings, and O&M manuals.

B. The Contractor shall submit detailed shop drawings and data prepared and organized by the suppliers. The quantity of submittal sets required shall be as specified in the Contract Documents.

C. The submittals shall be neatly grouped and organized by specification section number, and sub-section. Related information shall be highlighted, and the specific product shall

be marked. All submittals shall be complete, and presented in one package. Incomplete submittals will be returned without review. If a portion of the project requires a fast track schedule, that portion only may be submitted earlier under a separate cover letter. The following shall be submitted to the Engineer and returned, reviewed to the Contractor before fabrication is started.

1. A complete list of the equipment and materials, including the manufacturer's name, product specification, descriptive data, technical literature, performance charts, catalog cuts, installation instructions, and spare part recommendations for each different item of the equipment specified. The above shall clearly show all the specified requirements as described in the Specifications including but not limited to specific U.L. and NEMA rating, technical capabilities, test result verifications, Seismic Zone rating, and acceptance letters.

2. Drawings containing complete wiring and schematic diagrams, control diagrams, and any other details required to demonstrate that the system has been coordinated and will operate as intended. Drawings shall also show proposed layout, anchoring, support, and appurtenances of equipment, and equipment relationship to other parts of the work including clearances for maintenance and operations.

3. Any exceptions to these specifications, with the reasons for requesting such exceptions, with calculations and drawings for redesign of related components, including detail drawings showing internal and assembly details, with installation instructions. Proposed layout showing any modifications or exceptions to related work made necessary by this work, with calculations and drawings showing such modifications or exceptions.

4. Prior to project acceptance, The Contractor shall submit “Record Drawings” of the electrical, control, and instrumentation, along with step-by-step procedure manuals for the installation, operation start-up, and maintenance of the equipment. Each set shall include installation, operating, troubleshooting, and maintenance and overhaul instructions in complete detail. It shall also include possible breakdowns and repairs, and troubleshooting guides, as well as simplified wiring and control diagrams of the system installed. This shall provide the Owner with comprehensive information on all systems and components to enable operation, service, maintenance and repair. Exploded or other detailed views of all equipment, devices, assemblies, and accessory components shall be included, together with complete parts lists and ordering instructions.

5. Record Drawings:
    a. The Contractor shall maintain a marked up set of Contract Document Plans showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (larger than #12 AWG), and all other deviations from the design Plans.
    b. Underground conduit and concealed items shall be dimensioned on the Plans from permanent, visible, building features.
    c. The Contractor shall provide actual motor size, starter size, and overload heater size, along with all other protective equipment for all 480 V and motor circuits as part of the one-line record drawings.
    d. The Contractor shall revise all conductor identification and panel schedules to indicate as-built conditions.

PART 2 - PRODUCTS

2.01 GENERAL MATERIALS AND METHODS

A. Materials, equipment, and parts comprising any unit, or part thereof, specified or indicated on the Plans, shall be new and unused, of current manufacture, and of highest grade consistent with the state of the art. Damaged or dirty materials, equipment, and parts, are not considered to be new and unused, and will not be accepted.

B. Field verification of scale dimensions on Plans is directed, since actual locations, distances, and levels will be governed by actual field conditions. The Contractor shall also review architectural, structural, yard, mechanical, and other Plans, and the accepted electrical and mechanical shop drawings, and shall adjust their work to conform to the conditions indicated therein.

C. The fabricator of major components, such as distribution panelboards, switchgear, and motor control centers, shall also be the manufacturer of the major devices therein. Where possible, the major components shall be manufactured and supplied by the same fabricator.

D. Refer to various Division sections for individual equipment manufacturers. Indicated manufacturers are subject to strict compliance with the specifications and complete project documents. The reference to a particular manufacturer does not relieve the Contractor from conforming to the specified requirements.

2.02 NAMEPLATES

A. Where indicated elsewhere in these specifications, or on the Plans, the Contractor shall furnish and install nameplates, which shall be white laminate with black letters. The nameplates shall be fastened to the various devices with round head stainless steel screws. Each disconnecting means for service, feeder, branch, or equipment conductors shall have nameplates indicating its purpose.

2.03 EQUIPMENT ASSEMBLIES

A. Equipment assemblies, such as Service Entrance Sections, Switchgear, Switchboards, Control and Distribution Panels, and other custom fabricated electrical enclosures shall bear a UL label as a complete assembly. The UL label on the individual components making up the assembly will not be considered sufficient to meet the present requirement. Whenever a generic UL label does not apply for the assembly, a serialized UL label shall be affixed to the assembly, and the serial number shall be submitted with the assembly record shop drawings.

B. Custom fabricated electrical control panels, and enclosures shall bear a serialized UL label affixed by a local inspector, and the serial number shall be submitted with the assembly record shop drawings.

2.04 SEISMIC RESTRAINT

A. The construction area is classified by the Uniform Building Code (UBC) as Seismic Zone III. The Code requires that not only the structures, but also major electrical components be designed and installed in a manner which will preclude damage during a seismic event. All electrical equipment shall be securely anchored and seismic braced in accordance with regulations contained in the most recent adopted edition of the UBC, and the Sheet Metal and Air Conditioning Contractor's National Association (SMACNA) "Guidelines for Seismic Restraints of Electrical Systems".

B. Units mounted and secured directly to structure shall be provided with connectors of sufficient strength to meet the restraining criteria.

C. All electrical equipment which is securely anchored (hard mounted) to the building or structure shall have supports designed to withstand lateral and vertical "G" loadings equal to or greater than UBC requirements and SMACNA guidelines.

D. Shop drawings are required for all equipment anchors, supports and seismic restraints. Submittals shall include weights, dimensions, load/deflection data, center of gravity, standard connections, manufacturer's recommendations, and behavior problems (vibration, thermal, expansion, etc.) associated with equipment.

PART 3 - EXECUTION

3.01 UTILITY SERVICE AND EQUIPMENT

A. The Contractor shall be responsible for contacting and coordinating the electrical utility work with the electrical utility company. The Contractor shall be responsible for furnishing and installing equipment and material required to bring electrical power service to the service location in conformance with the electrical utility requirements. The Contractor may have to provide the following for the electrical utility company's primary (from utility power line to the utility transformer) and secondary (from utility transformer to the service) electrical lines in accordance with the electrical utility company's specifications and requirements:

1. Conduits and cables (verify quantity and sizes)
2. Trenching, backfill, and compacting (verify trench size(s), backfill material, and compaction percentage requirements)
2. Concrete pad(s) (for pad mounted transformer(s))
3. Cable protection along the vertical drop at the utility company's pole (if pole mounted transformer(s))
4. Other items required by the power utility company's specifications
5. The Contractor shall also submit copies of service entrance shop drawings to the utility, per utility submittal requirements, prior to submittal to the Engineer. The Contractor shall obtain written approval from the power utility company that the service entrance equipment is acceptable prior to release the order to the supplier for fabrication. A copy of the approval letter from the utility shall be transmitted to the Engineer along with the submittal.

3.02 INSTALLATION OF ELECTRICAL EQUIPMENT

A. Coordinate the installation of electrical equipment with other trades.

1. Arrange for the building in of equipment during structure construction.
2. Where equipment cannot be built-in during construction, arrange for sleeves, box-outs, and other openings, as required to allow installation of equipment after structure construction is complete.

B. Verify that equipment will fit support layouts indicated.

C. Equipment Dimensions and Clearances:

1. Do not use equipment that exceeds the indicated dimensions. Except as approved in writing by the Engineer.
2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.

D. Install equipment in accordance with the manufacturer's instructions.

E. Equipment Access:

1. Install equipment so it is readily accessible for operation and maintenance.
2. Equipment shall not be blocked or concealed.
3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.

F. Equipment shall be installed plumb, square and true with the building construction, and shall be securely fastened.

G. Outdoor wall-mounted equipment, and indoor equipment mounted on earth, or water bearing walls, shall be provided with corrosion-resistant spacers to maintain ¼-inch separation between the equipment and the wall.

H. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.

I. Equipment fabricated from aluminum shall not be imbedded in earth or concrete.

J. Provide all necessary anchoring devices and supports.

1. Use supports as detailed on the Plans and as specified.
2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
3. Hardware shall be stainless steel.
4. Do not cut, or weld to, building structural members.
5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.

K. Contractor shall verify exact rough-in location and dimensions for connection to electrical items furnished by others.

1. Shop drawings shall be obtained from those furnishing the equipment.
2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.
3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.
4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.
    a. The Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.
        1) Provide additional reinforcing if required.
        2) Cutting shall be done neatly using proper tools and methods.
    b. Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by the Contractor.

L. Provide concrete foundations or pads required for electrical equipment as indicated or specified.

1. Floor-mounted equipment shall be mounted on a 3-inch concrete housekeeping pad unless otherwise noted on the drawings. Pad shall be poured on top of the finished floor or slab. Contractor shall verify the distance to all equipment from the finished

floor meets the current NEC requirements. All modifications shall be made to the electrical equipment as required.

2. All conduits penetrating concrete floors shall have a 3-inch concrete housekeeping pad unless otherwise noted on the drawings. Conduits should be grouped as allowed to limit the number of housekeeping pads required.

3.03 TEMPORARY POWER

A. The Contractor shall furnish, install, and maintain, temporary power and lighting systems needed for construction. This temporary system shall include weatherproof panel(s) for the Contractor's main breakers and distribution system. Ground fault interrupting equipment shall be installed. Connections shall be watertight, with wiring done with Type SO portable cable. After construction is completed, the Contractor shall remove temporary power equipment and devices.

3.04 CUTTING AND REPAIRING

A. Where it becomes necessary to cut into existing work for the purpose of making electrical installations, core drills shall be used for making circular holes. Other demolition methods for cutting or removing shall be reviewed by the Engineer prior to starting the work.

B. The Contractor shall repair damage caused by construction, or demolition work, and restore damaged areas to original condition.

3.05 CORROSION PROTECTION

A. Wherever dissimilar metals, except conduit and conduit fittings, come in contact, the Contractor shall isolate these metals, as required, with neoprene washers, 9 mil polyethylene tape, or gaskets. Where fastening conduit, electro plated, or equivalent fasteners and stainless steel bolts shall be used.

B. Factory finishes damaged during shipping, or construction, shall be restored to original new condition. Rust shall be removed, and bare metal surfaces shall be primed and painted to match the original surrounding finish.

C. Electrical panels, switchgear, motor control centers, and other electrical equipment, shall be shipped in sealed dust and moisture proof plastic sheet enclosures, and the seal maintained until units are installed. Said units shall be new and free of any dirt, dust, water, grease, rust, damaged parts or components. Relays, starters, circuit breakers, switches, contacts, insulators, mechanisms, and buses shall be free of dust, dirt, oil, moisture, metal shavings, and other debris before testing and energizing.

D. Equipment shall be protected at all times with plastic sheet covers until the area is free of dirt, dust, paint spray, water, heat, and other trades. Heat shall be provided to eliminate condensation. All repairs due to storage will be the responsibility of the contractor.

3.06 COORDINATION OF THE ELECTRICAL SYSTEM

A. The Contractor shall verify actual equipment, and motor full-load, and locked-rotor current ratings. The necessary minimum equipment, wire, and conduit sizes are indicated on the Plans. If the Contractor furnishes equipment of different ratings, the Contractor shall coordinate the actual current rating of equipment furnished with the branch circuit conductor size, the overcurrent protection, the controller size, the motor starter, and the branch circuit overcurrent protection. The branch circuit conductors shall have a current carrying capacity of not less than 125 percent of the actual full-load current rating. The size of the branch circuit conductors shall be such that the voltage drop from the overcurrent protection devices, up to the equipment, shall not exceed 2 percent, when the equipment is running at full-load and rated voltage.

3.07 TESTING

A. The electrical work shall be free from improper grounds, and from short circuits. The correctness of the wiring shall be verified first by visual comparison of the conductor connections with connection diagrams. Next, individual circuit continuity checks shall be made by using electrical circuit testers. Last, the correctness of the wiring shall be verified by the actual electrical operation of the electrical and mechanical devices. Any deviation from the wiring indicated on the Plans, or accepted Drawings, shall be corrected and indicated on the record drawings.

B. Each conductor shall be identified as required by the Contract Documents. This identification shall be indicated on the record drawings to enable rapid and accurate circuit tracing by maintenance personnel.

3.08 ONE-LINE DIAGRAMS

A. One-line diagrams, as indicated on the Drawings, show circuit voltages, circuit protection rating, and other pertinent data. Where conflicts exist on the Drawings, the one-line diagrams shall take precedence. Grounding conductors are not necessarily indicated. See grounding requirements specified elsewhere herein.

END OF SECTION 16000

SECTION 16060 - ELECTRICAL DEMOLITION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Demolition of existing electrical shall be as indicated on the Plans or as indicated elsewhere herein.

B. Demolition information shown on the Plans is based on visual field examination and existing record drawings. The Contractor is responsible for verification of all items indicated or not. All items affected that are not indicated on the plans shall be brought to the Engineer's attention before demolition for direction.

C. The Contractor shall confine demolition work to the item specifically identified on the plans. The Contractor shall be liable for any other damage he may inflict to the existing installations.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Care shall be taken in demolition or removal of items as indicated on plans as being returned to the Owner. The Contractor shall notify the Owner prior to removing existing equipment.

B. Whether indicated on the plans or not, the Contractor shall provide patching material to fill voids where demolition has taken place. Patching materials shall match, as nearly as practical, the existing original structure material for each surface being patched.

PART 3 - EXECUTION

3.01 COORDINATION

A. The Contractor shall verify existing field conditions, measurement, circuitry etc. as indicated on Plans prior to performing any demolition.

B. The Contractor shall verify that abandoned or removed wiring and electrical equipment serve only abandoned facilities. If demolished or abandoned electrical is necessary for proper operation of facilities to remain in service, the Contractor shall immediately notify the Engineer for direction.

C. Demolition shall not be performed without coordinating with new construction to limit down time and ease of switchover. The Contractor must coordinate with the Engineer and the Owner prior to any demolition.

D. Prior to performing any demolition work, the Contractor shall provide temporary wiring and connections to maintain existing systems in service during construction. Temporary wiring shall conform to the National Electrical Code.

3.02 PERFORMANCE

A. General: The means and methods of performing electrical demolition and removal operations are the sole responsibility of the Contractor. However, equipment used, and methods of demolition and removal will be subject to approval of the Engineer.

1. Remove exposed abandoned conduit systems, including abandoned conduit systems in false ceilings.
2. Remove wiring in abandoned conduit systems to source of power supply, where indicated.
3. In exposed through-structure conduit or foundation locations, cut conduits and foundation below the finished structure surfaces in order to perform adequate surface patching.
4. Maintain electrical continuity of existing electrical installations that remain active. Modify installations as necessary to maintain continuity and provide adequate access as required by the National Electrical Code.
5. Extend existing installations using materials and methods compatible with existing electrical installations, and as specified elsewhere herein.
6. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed or demolished.

B. Cutting: Perform cutting work of existing structure materials by such methods as will prevent extensive damage beyond the immediate area of cutting.

C. Unless otherwise indicated existing, electrical equipment, conduit, wire, etc. indicated for demolition shall be removed and disposed of in a lawful manner, off site.

D. The Contractor shall move existing electrical equipment required to be returned to the Owner, to locations as directed by the Owner. Care shall be taken to ensure existing electrical equipment being returned to the Owner does not become damaged. The Contractor shall provide a means for storing and or stacking of the returned equipment prior to moving to final location, if necessary.

E. Items Abandoned in Place:

1. All items to be abandoned in place shall be de-energized.
2. Connections shown or otherwise indicated as disconnected shall be removed with lugs left in place and with all conduit and cable openings properly plugged and sealed as required by the NEC.
3. Any abandoned in-place equipment damaged by Contractor shall be repaired and restored to its original condition.

END OF SECTION 16060

SECTION 16111 - CONDUITS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install conduits as required, and as shown on the Plans. Materials employed shall be as shown on the Plans.

1.02 SUBMITTALS

A. Submit product literature including manufacturer part number, model number, material, size, and specifications. Material shall not be installed until the Engineer has reviewed the submittal data.

B. If changes from the Plan are proposed, shop drawings shall be submitted for review and acceptance showing routing, conduit size, and number and size of wires in each conduit before installation of conduit and any related work.

C. Proposed routing of conduits buried under floor slabs-on-grade.

D. Identify conduit by tag number of equipment served or by circuit schedule number.

E. Proposed routing and details of construction including conduit and rebar embedded in floor slabs, columns, etc.

F. Proposed location and details of construction for openings in slabs and walls for raceway runs.

G. Refer to Section 16000 for further submittal requirements.

1.03 REFERENCES

A. American National Standards Institute (ANSI): C80.1, Rigid Steel Conduit - Zinc-Coated.

B. National Electric Manufacturers Association (NEMA): RN-1, Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit.

C. Underwriters Laboratories Inc. (UL):
1. 1, Flexible Metal Conduit.
2. 6, Rigid Metal Conduit.
3. 360, Liquid-Tight Flexible Steel Conduit.
4. 467, Grounding and Bonding Equipment.
5. 514, Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers.
6. 651, Schedule 40 and 80 Rigid PVC Conduit.
7. 870, Wireways, Auxiliary Gutters, and Associated Fittings.
8. 884, Underfloor Raceways and Fittings.
9. 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

PART 2 - PRODUCTS

2.01 RACEWAYS

A. Exposed conduits in an unclassified or hazardous area shall be galvanized rigid steel (GRS) unless specifically indicated otherwise on the Plans. Conduits in corrosive, hazardous, or damp areas shall be PVC coated GRS unless otherwise indicated. Underground and/or concrete encased conduits shall be PVC, unless otherwise indicated.

All conduits concealed in block walls or steel framing shall be EMT with compression fittings unless otherwise indicated. Set screw type fittings in EMT conduit will not be accepted. All wiring, except as otherwise noted, shall be in conduit. Conduit size shall not be less than the National Electrical Code (NEC) size required for the conductors therein and shall not be smaller than 3/4-inch. No underground conduit shall be less than one inch.

B. Condulets type fittings shall be Crouse-Hinds, Appleton, or equal with wedge nut covers. All condulets located outdoors, damp or wet locations shall be weather tight.

C. In unclassified areas, flexible conduit shall be grounding type, weatherproof, corrosion resistant, and watertight.

D. Couplings, connectors, and fittings shall be standard types specifically designed and manufactured for the purpose. They shall be installed to provide a firm mechanical assembly and electrical conductivity throughout. Conduit systems shall be water tight.

E. Expansion fittings shall be OZ type AX with jumper for exposed locations and type DX at structural expansion joints, Spring City, or equal. Conduits shall have expansion fittings in accordance with NEC.

F. The conduits and fittings shall be supported per NEC requirements as a minimum.

G. Sealing fittings shall be provided for classified areas per the NEC requirements in hazardous or corrosive areas. Fittings shall be poured after the final walk-thru unless otherwise directed in writing by the engineer.

2.02 GALVANIZED RIGID STEEL (GRS)

A. Conduits and couplings shall be hot-dipped galvanized with zinc coated threads and outer coating of zinc bichromate, in accordance with ANSI C80.1 standards, as manufactured by Jones & Laughlin Steel Corporation, Allied Tube & Conduit Corporation, Triangle PWC, or equal.

B. Steel conduit shall not be buried in earth without concrete encasement and additional corrosion protection. A half lapped rapping of 20 mil PVC based corrosion protection tape shall be used.

2.03 PVC COATED GALVANIZED RIGID STEEL (PVC-GRS)

A. PVC coated GRS conduit shall be installed where shown on the Plans or elsewhere specified and shall conform to NEMA RN-1 and ANSI C80.1 standards.

B. The zinc surface of the conduit shall remain intact and undisturbed on both the inside and the outside of the conduit throughout the preparation and application processing. A Polyvinyl Chloride (PVC) coating shall be bonded to the galvanized outer surface of the conduit. The bond between the PVC coating and the conduit surface shall be greater than the tensile strength of the plastic. The thickness of the PVC coating shall be a minimum of 0.040-inch (40 mil).

C. A loose coupling shall be furnished with each length of conduit. A PVC coating shall be bonded to the outer surface of the coupling and a PVC sleeve equal to the outside diameter of the uncoated conduit shall extend beyond both ends of the coupling approximately one pipe diameter or 1-1/2 inches, whichever is smaller. The wall thickness of the coating on the coupling and the sleeve shall be a minimum of 0.055-inch (55 mil).

D. A PVC coating shall be bonded to the inner and outer surface of all conduit bodies and fittings and a PVC sleeve shall extend from all hubs. The wall thickness of the coating on conduit bodies and fittings and the sleeve walls shall be identical to those on couplings in length and thickness. The covers on all conduit bodies shall be coated on both sides and shall be designed to be completely interchangeable. The inside of conduit bodies shall remain undisturbed in the processing.

E. Type 304 stainless steel screws shall be furnished and used to attach the cover to the conduit body. All coated material shall be installed and patched according to the manufacturer's recommended installation and patching instructions.

F. Conduit straps shall be PVC coated or stainless steel.

G. PVC coated conduits and fittings shall be as manufactured by Kor Kap Corporation, Occidental Coating Company, Rob-Roy, or equal.

H. PVC coated flexible conduits shall be liquid and vapor-tight and manufactured in accordance with UL 360 standards.

2.04 RIGID NONMETALLIC - PVC

A. Where specifically indicated on the Plans, or elsewhere specified, conduit may be high density Schedule 40, 90 degrees C, heavy-duty PVC. The conduit shall be manufactured from virgin polyvinyl chloride compound which meets ASTM D1784, NEMA TC-2, ANSI C33.91, and UL 651 standards. Smoke emissions shall be limited to less than 6 grams per 100 grams of material tested.

B. Where conduit concrete encasement is indicated on the Plans, conduit supports shall be installed at five-foot intervals. PVC conduit shall be manufactured by Carlon, Triangle Conduit & Cable, or equal.

2.05 LIQUIDTIGHT FLEXIBLE METAL CONDUIT

A. Liquidtight flexible metal conduit shall be liquid and vapor-tight, oil and ultraviolet ray resistant and manufactured in accordance with UL 360 standards. Liquidtight flexible metal conduit shall be formed of a continuous, spiral wound, galvanized steel core with an extruded PVC jacket. The PVC jacket shall be rated for high ambient heat applications, 90 degrees Celsius.

B. For corrosive locations, liquidtight flexible metal conduit shall be formed of a continuous, spiral wound, aluminum core with an extruded PVC jacket. The PVC jacket shall be impervious to corrosive liquids and vapors.

C. An external bonding conductor shall be required for flexible conduit connections containing circuits rated at 60 amps or greater and for sizes 1 1/2 " or larger. Flexible conduits and connectors for 1 1/4 " and smaller shall be listed for grounding.

D. Connectors for liquidtight flexible conduit shall be galvanized, furnished with a sealing ring and locknut, and suitable for wet locations.

2.05 ELECTRICAL METALLIC TUBING (EMT)

A. Per UL Standard for Electrical Metallic Tubing No. 797. Galvanized mild steel with interior coat of enamel.

B. Fittings shall be steel set-screw type. Cast type, indenter type or compression steel fittings are not acceptable.

C. Approved for plan specified locations only. Approved for conduits concealed in block walls and concealed in steel framed walls. Not approved for process areas where wash down or high humidity conditions exist.

2.06 ALUMINUM CONDUIT

A. Aluminum conduit is approved for wet and corrosive areas only. Prior approval from the engineer must be obtained when substituting for PVC coated.

B. Aluminum hardware and conduit shall be isolated from all dissimilar materials as appropriate.

1. Isolation from dissimilar metals in channel or support by a single layer of scotch #33+ or approved equal.
2. Isolation from concrete shall be by neoprene gaskets.
3. Aluminum shall not be used for concrete penetrations.

C. Aluminum conduit shall contain less than 0.4% copper

PART 3 - EXECUTION

3.01 INSTALLATION

A. Conduit runs are schematic only, and shall be modified as required to suit field conditions, subject to review and acceptance by the Engineer.

B. Conduit shall run continuously between outlets and shall be provided with junction boxes where connections are made. Couplings, connectors, and fittings shall be acceptable types designed and manufactured for the purpose, and shall provide a firm mechanical assembly, and electrical conductivity throughout.

C. Conduit runs shall be straight and true. Elbows, offsets, and bends shall be uniform and symmetrical. Changes in direction shall be made with long radius bends, or with fittings of the condulet type.

D. Conduit runs in buildings and structures shall be concealed where possible except as specifically noted, or accepted by the Engineer.

E. Conduit runs shall not interfere with the proper and safe operation of equipment, and shall not block or interfere with ingress or egress, including equipment removal hatches.

F. Exposed conduits shall be securely fastened with clamps, or straps, intended for conduit use. All exposed conduit shall be run on the walls and ceiling only and shall be parallel to the planes of the walls or ceiling. No diagonal runs will be permitted. Flexible conduit shall be used only for short lengths required to facilitate connections between rigid conduit to vibrating equipment such as motors, fans, and transformers. The maximum length of flexible conduit shall be 3 feet, unless approved in writing by engineer. Flexible conduit shall not be used for electricians convenience where rigid conduit could be used.

G. Conduit runs on water-bearing walls shall be supported one inch away from the wall on an accepted channel. When channel galvanizing, or other coating, is cut or otherwise damaged, it shall be field coated to original condition. No conduit shall be run in water-bearing walls, unless specifically designated otherwise.

H. Conduit shall be thoroughly reamed to remove burrs. IMC or GRS shall be reamed during the threading process, and Rigid Nonmetallic PVC shall be reamed before applying fittings. A zinc rich cold galvanizing shall be used to restore corrosion protection on field cut threads.

I. Bushings and lock nuts or hubs shall be used at conduit terminations. Conduit, bushings, locknuts, and enclosures shall be fastened to the conduit system prior to pulling wire. Splitting the bushings for installation will not be accepted. Hubs shall be used in all process areas outside of electrical rooms unless otherwise specified. The total number of bends in any run between pull points shall not exceed 360 degrees. Junction boxes and pull boxes shall be installed at points acceptable to the Engineer. Conduit ends shall be plugged to prevent the entrance of moisture or debris during construction. All spare conduits shall be adequately capped and shall contain a suitable pull string. Splices shall be made in junction boxes only. Splices in conduit bodies will not be accepted.

J. Joints shall be set up tight. Hangers and fastenings shall be secure, and of a type appropriate in design, and dimensions, for the particular application.

K. Conduit runs shall be cleaned and internally sized (obstruction tested) so that no foreign objects, or obstructions remain in the conduit prior to pulling in conductors.

L. After installation of complete conduit runs 2 inches and larger, conduits shall be snaked with a conduit cleaner equipped with a cylindrical mandrel of a diameter not less than 85 percent of the nominal diameter of the conduit. Conduits through which the mandrel will not pass shall not be used. Test results should be submitted to the engineer.

M. Expansion fittings shall be installed across all expansion joints and at other locations where necessary to compensate for thermal expansion and contraction.

N. Provide trenching, backfill, and compaction for conduits installed underground.

END OF SECTION 16111

SECTION 16123 - 600 VOLT CLASS CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section covers the furnishing and installation of 600 Volt Class cables and conductors, terminations and splicing, and pulling lubricants.

B. SO & SJO Conductors are specified elsewhere in these specifications.

1.02 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

1.03 REFERENCES

A. Insulated Cable Engineers Association/National Electrical Manufacturers Association (ICEA/NEMA):

1. S-68-516/WC 8, ethylene-propylene rubber-insulated wire and cable for the transmission and distribution of electrical energy.
2. S-61-402/WC 5, thermoplastic-insulated wire and cable for the transmission and distribution of electrical energy.
3. S-66-524/WC 7, cross-linked thermosetting-polyethylene-insulated wire and cable for transmission and distribution of electrical energy.

B. Underwriters Laboratory, Inc.

1. 44, rubber insulated wires and cables.
2. 83, thermoplastic-insulated wires and cables.
3. 486A, wire connectors and soldering lugs for use with copper conductors.
4. 486B, wire connectors for use with aluminum conductors.
5. 510, insulating tape.

C. National Electric Code

D. Insulated Cable Engineers Association

PART 2 - PRODUCTS

2.01 ACCEPTED MANUFACTURERS

A. Conductors and Multi Conductor Cables (MCC), subject to compliance with Contract Documents, the following manufacturers are acceptable: American Insulated Wire Corporation, Cablec Corporation, Okonite Company, Southwire Company, or equal.

2.02 CONDUCTORS

A. Wire sizes shall be American Wire Gauge (AWG) sizes with Class B stranded construction. Number 2 AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape. Conductors #6 AWG or smaller shall be THWN or XHHW. Conductors #2 AWG or smaller shall be XHHW. Conductors #1 AWG or larger shall be XHHW-2. The minimum power or ground conductor size shall be #12 AWG.

B. Individual or multiple conductor cables for power, control, and alarm circuits of 480 volts or less shall be insulated for not less than 600 volts and shall have insulation type as indicated on the Plans. "THHW" shall conform to ICEA S-61-402/NEMA WC 5 and UL 83 and "XHHW" shall conform to ICEA S-66-524/NEMA WC 7 and UL 44. Where wire size is not indicated, they shall be of the size required by the NEC, except that no wire external to panels and motor control centers shall be less than No. 12 AWG, unless specifically noted on the Plans. Panel control wiring shall not be less than No. 14 AWG.

C. Multi-conductor tray cables shall be rated 600 volts, listed by UL as Type TC cable or ITC for instrumentation cable only per Article 340 of the NEC. The individual conductors shall be UL listed as Type XHHW, with a sunlight-resistant overall jacket. Conductor sizes shall be the same as for power and lighting wire and control wire above. Connectors/Terminators shall be water tight and manufactured of the same material as the cabling system referenced elsewhere in division 16.

D. Multi-conductor tray cables to be installed in classified areas shall be armored, rated 600 volts, listed by UL as Type MC-HL cable per Article 340 of the NEC. The individual conductors shall be UL listed as Type XHHW, with a sunlight-resistant overall jacket. Conductor sizes shall be the same as for power and lighting wire and control wire above. Connectors/terminators shall be rated for classified areas and submitted upon accordingly.

E. All wiring shall be as indicated on the Plans. Wires shall be new and shall be soft drawn copper with not less than 97 percent conductivity. The wire and cable shall have size, grade of insulation, voltage, and manufacturer's name permanently marked on the outer covering at not more than 2-foot intervals. All wires shall conform to the latest Standards of the ASTM, and ICEA, and shall be tested for their full length by these Standards. Insulation thickness shall be not less than that specified by the National Electrical Code.

2.03 TERMINATIONS AND SPLICES

A. Cable shall be rated 600 volts. Other parts of cable systems such as splices and terminations shall be rated at not less than 600 volts. Splicing shall join conductors mechanically and electrically to provide a complete circuit prior to installation of insulation.

B. Splices in wires No. 10 AWG and smaller shall be made with an insulated, solderless, pressure type connector, Type I, Class 1, Grade B, Style G, or Type II, Class 1 of FS W-S-610 and conforming to the applicable requirements of UL 486A.

C. Splices in wires No. 8 AWG and larger shall be made with noninsulated, solderless, pressure type connector, Type II, Class 2 of FS W-S-610, conforming to the applicable requirements of UL 486A and UL 486B. They shall then be covered with an insulation and jacket material equivalent to the conductor insulation and jacket.

D. Insulated conductor splices below grade or in wet locations shall be sealed type conforming to ANSI C119.1 or shall be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

E. Bare conductor splices in wet locations or below grade shall be of the exothermic type.

2.04 PULLING LUBRICANT

A. All cables shall be properly coated with pulling compound (Aqua Gel, Polywater, or equal) before being pulled into conduits so as to prevent mechanical damage to the cables during installation. “Yellow 77” is not acceptable.

B. Other lubricants to be substituted must be accompanied by a statement from the cable manufacturer as to its acceptable use with the cable being installed.

2.05 IDENTIFICATION

A. All conductors shall be numbered with "tube sleeve" type tags with heat impressed letters and numbers.

B. Color code all wiring as follows:

1. Lighting and power wiring:

		120/208 VAC	480VAC	12V DC	24V DC	120 VAC Control/ Power
a.	Phase 1	Black	Brown	Orange	Blue	Red
b.	Phase 2	Red	Orange			
c.	Phase 3	Blue	Yellow			
d.	Neutrals	White	White	Grey	Blue/White	White

2. Color code ends of feeder phase conductors only.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The pulling tension and side-wall pressures, as recommended by the cable manufacturer, shall not be exceeded.

B. As far as practical, all circuits shall be continuous from origin to termination without splices in intermediate pull boxes. Sufficient slack shall be left at the termination to make proper connections. In no case shall a splice be pulled into the conduit. Conductor splicing shall not be permitted without the Engineer's approval. Conductor splices shall not be made in underground junction boxes or manholes unless specifically noted on the plans.

C. Install all cables in conduit. Manufacturer’s cables and SO cord may be installed without conduit where approved and noted on the plans.

D. Each feeder and branch circuit shall be installed in its own individual conduit unless combining feeder and branch circuits is permitted as defined in the following:

1. As specifically indicated on the Plans.
2. For lighting, multiple branch circuits may be installed in a conduit as allowed by the NEC and with the wire ampacity de-rated in accordance with the requirements of the NEC. Conduit fill shall not exceed the limits established by the NEC.
3. When field conditions dictate and written permission is obtained from the Engineer.

E. Feeder and branch circuits shall be isolated from each other and from all instrumentation and control circuits.

F. Control circuits shall be isolated from all other feeder, branch and instrumentation circuits, except as noted above.

1. 12 V DC, 24 V DC and 48 V DC control circuits may be combined in common conduit.
2. 120/208/240 V AC control circuits shall be isolated from all DC control circuits.
3. 277/480 V AC circuits shall be isolated from all other voltages.

G. Single conductor cable in cable trays shall be No. 1/0 or larger and shall be of a type listed and marked for use in cable trays. Tray cable smaller than 1/0 shall be multi-conductor, with outer jacket.

H. Make splices only at pull or junction boxes.

1. Crimp or indented-type connectors are not allowed, unless approved by engineer.

END OF SECTION 16123

SECTION 16124 - INSTRUMENTATION CLASS CABLE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section covers cable use for process signal and controls.

1.02 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with Contract Documents, the instrumentation cable shall be as manufactured by Belden, Okonite, or equal.

2.02 INSTRUMENTATION CABLE

A. Instrument cable shall be Type TC, and have the number of individually shielded twisted pairs indicated on the Plans and shall be insulated for not less than 600 volts. Unless otherwise indicated, conductor size shall be No. 18 AWG minimum. Shielded, grounded instrumentation cable shall be used for all analog and low voltage digital signals.

B. The jacket shall be flame retardant with 90 degrees C temperature rating. The cable shield shall be a minimum of 2.3 mil aluminum or copper tape overlapped to provide 100 percent coverage and a tinned copper drain wire.

C. The conductors shall be bare soft annealed copper, Class B, 7 strand minimum concentric lay with 15 mils nominal thickness, nylon jacket, 4 mil nominal thickness, 90 degrees C temperature rating. One conductor within each pair shall be numerically identified.

D. Pairs shall be assembled with a nominal 2-inch lay and shall then be group shielded with a minimum of 1.3 mil aluminum or copper tape overlapped to provide 100 percent coverage. All group shields shall be completely isolated from each other.

E. Pairs installed in a cable tray shall have a UV resistant jacket, and shall have a jacket intended for cable tray use.

2.03 COPPER NETWORK CABLING

A. Outside Plant Cabling (OSP) – Shielded CAT6: 4-Pair solid annealed copper

1. 4-pair 23 AWG solid annealed copper
2. OSP rated cable for outdoor installation, gel filled core with black polyethylene jacket.
3. Aluminum foil shield
4. 500MHz transmission performance
5. ANSI/TIA-568-C.2; ANSI/ICEA S-107-704-2006

PART 3 - EXECUTION

3.01 INSTALLATION

A. Feeder and branch circuits shall be isolated from each other, and from instrumentation and control circuits. Instrumentation cables shall be installed in separate raceways from other cables and wiring. This includes portions running through manholes. Instrumentation cable shall be continuous between instruments or between field devices and instrument enclosures. There shall be no intermediate splices or terminal boards, unless otherwise shown on the Plans.

B. Maintain electrical continuity of the shield when splicing twisted shielded pair conductors. Drain wires shall be terminated inside enclosures at grounded terminal blocks. Only one end of each instrument loop cable drain wire shall be grounded. Ground drain wires of shielded conductors at one end only.

C. Terminate instrumentation and control wiring, including spare wires, at control panels and motor control centers on terminal boards mounted inside the equipment.

1. Contractor shall supply terminal boards as required.
2. Do not field wire directly to devices.

END OF SECTION 16124

SECTION 16130 - OUTLET, PULL, AND JUNCTION BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Outlet, pull and junction boxes.

B. Related Sections include but are not necessarily limited to:

Division 0	Bidding Requirements, Contract Forms, and Conditions of the Contract.
Division 1	General Requirements.
Section 16000	General Electrical Requirements.
Section 16111	Conduits.
Section 16141	Wiring Devices.
Section 16170	Grounding.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. Refer to Section 16000.

1.03 SUBMITTALS

A. Shop Drawings:

1. See Section 16000.

1.04 DELIVERY, STORAGE, AND HANDLING

A. See Section 16000.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Galvanized steel boxes:
   a. Appleton Electric Co.
   b. Steel City.
   c. Raco.
2. Sheet metal boxes for non-classified areas:
   a. Hoffman Engineering Co.
3. Corrosion-resistant boxes:
   a. Hoffman Engineering Co.
   b. Crouse-Hinds.
4. Hazardous location boxes (Class I, II & III):
   a. Appleton Electric Co.
   b. Crouse-Hinds.

c. Killark.
d. O-Z/Gedney.

5. Raintight and watertight boxes:
   a. Appleton Electric Co.
   b. Crouse-Hinds.
6. Terminal boxes:
   a. Hoffman Engineering Co.
7. Boxes in sidewalk:
   a. Appleton Electric Co.
   b. Crouse-Hinds.
   c. O-Z/Gedney.
8. Boxes in earth:
   a. Carlon Electric Products.
9. Exposed switch and receptacle boxes:
   a. Appleton Electric Co.
   b. Crouse-Hinds.
   c. Killark.
10. Concrete Manholes
    a. Dura Crete
    b. Or equal

B. Submit requests for substitution in accordance with Specification requirements.

2.02 MATERIALS

A. Pull and Junction Boxes for Offices and other Dry Architecturally Finished Areas:

1. Material: 14 GA, galvanized steel.
2. Concentric knockouts on all four sides.
3. Flat cover fastened with screws.
4. NEMA 1 classification.
5. UL listed.

B. Pull and Junction Boxes for General Use Unclassified Areas Suitable for NEMA 12 Enclosures:

1. Material: 14 GA galvanized steel with seams continuously welded, ground smooth and no knockouts.
2. Zinc rich coating on all seams.
3. Stainless steel captivated cover screws threaded into sealed wells.
4. Flat door with oil resistant gasket.
5. NEMA 12 classification.
6. UL listed.

C. Pull and Junction Boxes for Wet Areas:

1. Material: 14 GA steel with polyester powder coating inside and out over phosphatized surfaces.
2. Seams continuously welded, ground smooth, no knockouts.
3. Stainless steel clamps on four sides.
4. Flat cover with oil resistant gasket.
5. NEMA 4 classification.
6. UL listed.

D. Pull and Junction Boxes for Corrosive Areas:

1. Material: 14 GA steel with powdered epoxy resin coating inside and out or fiberglass-reinforced polyester material.
2. Steel boxes:
   a. Seams continuously welded, ground smooth, no knockouts.
   b. Rolled lip around all sides.
   c. Hinged door.
   d. Captivated stainless steel door screws.
   e. Flat door with oil-resistant gasket.
3. Fiberglass-reinforced polyester boxes:
   a. Hinged door with latch and lockout.
   b. Neoprene door gasket.
   c. Grounding bushing(s).
4. NEMA 4X classification.
5. UL listed.

E. Pull and Junction Boxes for Hazardous Areas:

1. Material: Cast gray iron alloy or copper-free cast aluminum.
2. Drilled and tapped openings or tapered threaded hub equipped.
3. Flat bolted-down or threaded cover with neoprene gasket.
4. Stainless steel hex head screws.
5. Explosion proof, UL listed for Class 1 Groups C and D.

F. Pull and Junction Boxes for Sidewalks:

1. Cast-iron box and cover, hot-dip galvanized.
2. Flange for flush mounting.
3. Checkered cover with neoprene gasket, pry bar slots and stainless steel screws.
4. UL listed.
5. Drilled and tapped holes.
6. Watertight NEMA 4 classification.

G. Large Pull and Junction Boxes (100 CU IN and larger):

1. Located in offices and other dry architecturally finished areas where EMT is utilized:
   a. NEMA 1 gasketed without knockouts.
2. Located in general use areas:
   a. NEMA 12 construction:
      1) Welded steel.
      2) Furnished with gray enamel inside and out over phosphatized surfaces.
3. Located in wet and corrosive areas:
   a. NEMA 4X with stainless steel screws.
   b. Type 304 L welded stainless steel:
4. Constructed of 14 GA steel with seams continuously welded, ground smooth, no knockouts.
5. Rolled lip around all sides.
6. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
7. Split covers when heavier than 25 LBS.

H. Terminal Boxes:

1. Galvanized 16 GA steel box provided with plain blank screw cover, subpanel, and terminal points.
2. Refer to Drawing for dimensions and number of terminals.

3. Terminal blocks shall be screw-post barrier-type, white center marker strip.
4. Rated 20 ampere, minimum 600 V.

I. Fiberglass Cable-Pulling Enclosure:

1. Use: Access points to facilitate pulling of electrical cables in buried conduit runs.
2. Size and quantity: As shown on Drawings.
3. Type: Rectangular fiberglass composite, suitable for direct burial pedestrian traffic on top, -50 DegF, chemical, sunlight, and weather resistant.
4. Provide matching top with "ELECTRIC" logo.

J. Outlet Boxes:

1. Use: Installation of wiring devices.
2. Boxes for exposed wiring:
   a. Cadmium plated, cast, ferrous metal, with threaded hubs.
3. Boxes for concealed wiring:
   a. Code gage, hot-dip galvanized steel.
   b. Include bar hangers for metal stud partitions.
   c. Provide barriers between switches in boxes with 277 V switches on opposite phases.
   d. Use extension and plaster rings where required.
   e. Provide grounding screw.

K. Concrete Manholes

1. Use: Duct bank pulling location or splitting of duct bank.
2. Size and quality: As shown on Drawings
3. Type: Concrete traffic rated with rebar re-inforcing.
4. Other requirements:
   a. 30 inch diameter minimum opening with traffic rated cover. Cover shall contain the legend “Electrical”.
   b. 3 inch deep 6 inch wide minimum dimension sump shall be provided in the center of the manhole.
   c. Contractor shall install a 20 amp GFCI weatherproof in use receptacle in the manhole. Receptacle shall be located at the highest point on the wall of the manhole.
   d. Pulling eyes shall be provided on all four walls.
   e. Thin Wall blockouts shall be provided on all four walls.
   f. Contractor to seal manhole penetrations to eliminate leaks at the junction between the conduits and the manhole.
   g. Train cables around sides of manhole during installation. Keep cables away from sump and receptacle.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Use locknut and bushing for boxes in non-classified areas.

B. Use cast metal boxes with threaded conduit hubs in damp, wet or hazardous areas.

C. Use Type FS and FD boxes in wet areas and where exposed rigid steel conduit is required.

D. Use epoxy resin coated, stainless steel, cast aluminum or fiberglass boxes for corrosive areas.

E. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.

F. Use outlet boxes sized to accommodate quantity of conductors enclosed.

G. Use boxes sized to accommodate conduit tying into box.

H. Install pull boxes or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.

1. Make covers of boxes accessible.

I. Install pull boxes or junction boxes rated for the area classification.

J. Install rigid conduit squarely into boxes which do not have hubs or are drilled and tapped.

1. Install with locknut on the outside and bushing on inside.

K. Install conduit into boxes with hubs, or that are tapped, using thread lubricant.

L. Do not use back-to-back boxes on this Project.

M. Seal all points of conduit entry into fiberglass cable-pulling enclosures for a waterproof installation.

N. Support outlet boxes for incandescent fixtures and other ceiling-mounted devices in lay-in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.

END OF SECTION 16130

SECTION 16141 - WIRING DEVICES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Light switches, receptacles, device plates, dimmers, plug-in strips and tele-power poles.

B. Related Sections include but are not necessarily limited to:

Division 0	Bidding Requirements, Contract Forms, and Conditions of the Contract.
Division 1	General Requirements.
Section 16000	General Electrical Requirements.
Section 16130	Outlet, Pull, and Junction Boxes.
Section 16170	Grounding.

1.02 QUALITY ASSURANCE

A. Referenced Standards:

1. Refer to Section 16000.

1.03 SUBMITTALS

A. Shop Drawings:

1. Refer to Section 16000.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:

1. Light switches (except explosion proof):
   a. Hubbell.
   b. Slater.
   c. P&S.
   d. Arrow Hart.
   e. General Electric.
   f. Leviton.
2. Explosion proof light switches (Class 1 Div I & II):
   a. Crouse-Hinds.
   b. Appleton Electric Co.
   c. Killark.
3. Door switches:
   a. General Electric.
   b. Slater.
   c. P&S.
   d. Arrow Hart.

e. Micro-switch.

4. Receptacles (except explosion proof):
   a. Hubbell.
   b. Slater.
   c. P&S.
   d. Arrow Hart.
   e. General Electric.
   f. Leviton.
5. Explosion proof receptacles (Class 1 Div I & II):
   a. Crouse-Hinds.
   b. Appleton Electric Co.
   c. Killark.
6. Welding receptacles:
   a. Crouse-Hinds.
   b. Appleton Electric Co.
7. Tele-power poles:
   a. Wiremold.
   b. Walker.
8. Dimmers:
   a. Lutron.
   b. General Electric.
   c. P&S.
9. Plug-in strip:
   a. Wiremold.
   b. Walker.

B. Submit requests for substitution in accordance with Specifications.

2.02 MATERIALS

A. Light Switches for Unclassified Areas:

1. Toggle type, quiet action, specification grade with grounding terminal.
2. Back and side wired.
3. Solid silver cadmium oxide contacts.
4. One-piece switch arm rated 20 A, 120/277 V AC.
5. UL listed.
6. Color: White unless owner or engineer specifies otherwise.
7. Wall plate: Type 304 stainless steel.
8. Type: As indicated on Drawings.

B. Receptacles for Unclassified Areas:

1. Straight blade, grounding type, specification grade.
2. Back and side wired with wrap-around bridge.
3. Rated 20 A, 125 V AC.
4. UL listed.
5. Color:
   a. For use on normal power: White unless owner or engineer specifies otherwise.
   b. For use on UPS systems: Red.
   c. For use on isolated ground systems: Orange.
   d. For special purpose receptacles: Black
6. Wall plate: Type 304 stainless steel.
7. Type: As indicated on Drawings.

C. Light Switches for Wet Areas:

1. Presswitch type, quiet action, specification grade, with grounding terminal.
2. Back and side wired.
3. Solid silver cadmium oxide contacts.
4. One-piece switch arm rated 20 A, 120/277 V AC.
5. UL listed.
6. Color: White unless owner or engineer specifies otherwise.
7. Wall plate: Gray weatherproof presswitch type.
8. Type: As indicated on Drawings.

D. Receptacles for Wet Areas:

1. Straight blade, grounding type, specification grade.
2. Back and side wired with wrap around bridge.
3. Rated 20 A, 125 V AC.
4. UL listed.
5. Color: Ivory.
6. Wall plate: Weatherproof, cast aluminum, UL listed.
7. Type: As indicated on Drawings.

E. Ground Fault Circuit Interrupter Receptacles:

1. Straight blade, grounding type, specification grade.
2. Rated 20 A, 125 V AC.
3. UL listed.
4. Test and reset buttons.
5. Wall plate: Indoor or weatherproof as required.
6. Feed-through type.

F. Light Switches for Corrosive Areas:

1. Corrosion-resistant NEMA 4X enclosure with switch consisting of:
   a. Fiberglass reinforced polyester enclosure.
   b. Fiberglass reinforced polyester gasketed wall plate with built-in toggle lever switch with stainless steel shaft.
   c. Grounding bushing.
   d. Rated 20 A, 125 V AC.
   e. UL listed.
   f. Type: As indicated on Drawings.
   g. Color: Yellow.
2. Optional: Corrosion-resistant enclosure and switch consisting of:
   a. Cast copper-free aluminum "FS" or "FD" ridge type hub box.
   b. Toggle type, quiet action, specification grade with grounding terminal.
   c. Rated 20 A, 125 V AC with solid silver cadmium oxide contacts.
   d. UL listed.
   e. Neoprene gasket.
   f. Cast aluminum cover with stainless steel screws and lever to activate switch.
   g. Type: As indicated on Drawings.
   h. Color: Yellow.

G. Receptacles for Corrosive Areas:

1. Corrosion-resistant straight blade, grounding type, specification grade.

2. Back and side wired with wrap-around bridge.
3. Rated 20 A, 125 V AC.
4. UL listed.
5. Color: Yellow.
6. Box: "FS" or "FD" ridge type cast hub box of copper-free aluminum.
7. Gasket: Neoprene.
8. Wall plate: Weatherproof, cast aluminum, UL listed, WDL open or closed.
9. Type: As indicated on Drawings.

H. Explosion proof Light Switches for Use in Hazardous Areas:

1. Explosion proof, UL listed for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2 areas, Groups E, F, and G.
2. EDS factory sealed.
3. Malleable iron body and cover.
4. Aluminum sealing chamber.
5. Front operated handle with stainless steel shaft.
6. Rated 20 A, 125 V AC.
7. With grounding screw.
8. Type: As indicated on Drawings.

I. Explosion proof Receptacles for Use in Hazardous Areas:

1. Explosion-proof, UL listed for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2, Groups F and G.
2. Factory-sealed malleable iron receptacle with spring-loaded cover.
3. Malleable iron mounting box.
4. Rated 20 A, 125 V AC.
5. "Dead-front" construction requiring plug to be inserted and rotated to activate receptacle.
6. Type: As indicated on Drawings.

J. Welding Receptacles:

1. 60 A, 480 V, 3 pole, 4 wire, grounding type.

K. Plug-In Strip: Surface steel raceway plug-in strip with single 15 A, 125 V, 3 wire grounding-type receptacles spaced 18 IN on center.

1. Pre-wired with two #12 TW and one #12 TW green insulated ground.
2. Minimum 1-1/4 IN wide x 3/4 IN deep.
3. Suitable fittings and snap-in cover.
4. Finish:
a. Stainless steel.
5. Receptacle color:
   a. For use on normal power: White unless owner or engineer specifies otherwise.
   b. For use on UPS systems: Red.
   c. For use on isolated ground systems: Orange.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mount devices where indicated on the Drawings.

B. Surface mount receptacles and light switches in concrete construction.

C. In masonry and metal stud construction, recess mount receptacles and light switches unless device precludes recessed mounting or unless otherwise noted on the Drawings.

D. Where more than one receptacle is installed in a room, they shall be symmetrically arranged.

E. Set switches and receptacles plumb and vertical to the floor.

F. Set recess-mounted switches and receptacles flush with face of walls.

G. Do not connect dimmers to loads in excess of 80% of the rating of the dimmer.

H. Provide blank plates for empty outlets.

END OF SECTION 16141

SECTION 16142 - WEATHERPROOF WHILE IN USE OUTLET ENCLOSURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. These specifications encompass outlet enclosures used on outlet devices where outlets are required to be weatherproof and/or physically protected while in use or idle.

B. These safety outlet enclosures shall be used in locations where attachment plugs will be connected permanently, or for an indefinite period of time, in potentially wet or weather exposed environments.

C. They are also to be used where outlets are subject to contamination, corrosion or damage.

1.02 DESCRIPTION

A. The safety outlet enclosure shall consist of a suitable style outlet/receptacle plate with a hinged safety cover.

B. The safety outlet enclosure shall have cord port(s) capable of allowing an appropriate size electrical cord(s) to pass through when safety cover is closed.

C. The safety outlet enclosure shall have a latching mechanism to allow the enclosure to maintain weatherproof integrity. The latch shall be a tamper resistant (locking/security) style in areas where security is needed.

D. The safety outlet enclosure shall be sufficient depth to allow full closure with attachment plug(s) in use.

1.03 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and the Contract Documents, prior to installation.

1.04 MANUFACTURER

A. Manufacturer shall be Taymac Corporation, or equal.

PART 2 - PRODUCTS

2.01 WEATHERPROOF WHILE IN USE OUTLET ENCLOSURES

A. The enclosures shall be used in outdoor locations, where attachment plugs will be connected permanently, or for an indefinite period of time, in potentially wet or weather exposed environments, or as indicated on the Plans.

B. They are also to be used where outlets are subject to contamination, corrosion or damage.

C. The enclosure shall consist of a suitable style outlet/receptacle plate with a hinged safety cover, and shall be of sufficient depth to allow full closure with attachment plugs in use.

D. The enclosure shall have cord ports capable of allowing appropriate size electrical cords to pass through when safety cover is closed.

E. The enclosure shall have a latching mechanism to allow the enclosure to maintain weatherproof integrity. The latch shall be a tamper resistant, and locking style, in areas where security is needed, as shown on the Plans.

F. The enclosure shall be Underwriters Laboratories (UL) listed per UL Standard 514C for non-metallic boxes, flush device boxes and enclosures, and conform to National Electric Code (NEC), Article 410.57 paragraphs a and b, Article 110.3 and Article 110.11, pertaining to damp, wet or possible corrosive installations.

G. Body materials shall be of a flame resistant, self extinguishing, ultraviolet inhibiting, impact resistant, polycarbonate resin such as GE Lexan 943A, or Mobay Makrolon 6457. Material must meet UL Standard 94.

H. Gasket materials shall be of sufficient thickness to form a weatherproof seal under normal mounting conditions. Thicknesses; 3/16" for base plate and 1/8" for covers. Material is to be closed cell neoprene foam by Monarch Rubber A5032, or equivalent, self extinguishing and flame retardant. Material must meet UL Standard 94 HF1.

I. Mounting hardware shall be stainless steel, and of sufficient length to properly secure the device, and ensure seal to mounting surface.

J. The enclosures shall be installed over a weatherproof box and outlet in conformance with the manufacturer's instruction. Cover shall be mounted to insure that access holes for the portable line cords will be located at the lower end of the cover.

K. Manufacturer shall be Taymac Corporation, or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Equipment shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION 16142

SECTION 16160 – ENCLOSURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This specification includes enclosures to house electrical controls, instruments, terminal blocks, and serve a junction boxes where shown on the Plans.

1.02 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

1.03 MANUFACTURERS

A. Enclosures shall be manufactured by Hoffman, Rittal, or equal.

PART 2 - PRODUCTS

2.01 STEEL

A. Enclosures shall be fabricated from 14 gauge steel with seams that are continuously welded. Doors shall have full length piano hinges with the door removable by pulling the hinge pin.

B. A rolled lip shall be provided around three sides of the door and around all sides of the enclosure opening. The gasket shall be attached with oil-resistant adhesive and held in place with steel retaining strips. Exterior hardware, such as clamps, screws, and hinge pins, shall be of stainless steel for outdoor installations. A hasp and staple shall be provided for padlocking. Each enclosure shall have a print pocket. All wires entering or leaving the enclosure shall terminate on terminal strips. All wires and terminals shall be clearly identified as specified elsewhere in these specifications.

C. Finish shall be white enamel interior, light gray enamel, ANSI 61 exterior, over phosphatized surfaces. Special finishes and colors shall be furnished for wet locations. Plans should be checked for special conditions.

2.02 NEMA RATING

A. Unless otherwise indicated on the Plans, enclosures shall be NEMA 12 for indoors, NEMA 4X for corrosive areas, and NEMA 4 for outdoor installations. NEMA 4X enclosures shall be stainless steel, unless noted otherwise. NEMA 4X enclosures shall also be used in wet, or wash down areas.

B. All enclosures used in classified areas shall be NEMA 7.

C. In Waste Water facilities all enclosures in process areas shall be NEMA 4X stainless steel. Enclosures in electrical rooms, meeting rooms, offices and shops shall be NEMA 12 unless otherwise specified.

D. Areas not specified in Water Treatment, Wastewater, or other water related facilities shall be approved by the engineer for NEMA type prior to installation.

2.03 FIBERGLASS

A. Enclosures shall be heavy-duty, compression molded, fiberglass reinforced polyester, high impact, heat resistant, NEMA 4X.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Enclosures shall be installed as indicated on the Plans, and according to manufacturer's instructions.

B. Enclosures shall be properly grounded, and shall include ground straps connected to hinged doors and accessories.

END OF SECTION 16160

SECTION 16170 - GROUNDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. A ground grid system consisting of the indicated configuration of copper wires, and ground rods, or concrete encased grounding electrodes ("UFER's") shall be provided to minimize station potential gradient irregularities and drain leakage and fault currents to earth.

B. Whether indicated on the Plans or not, neutral conductors, cable shields, metallic conduits, cable terminations, junction boxes, poles, surge arresters, metal buildings, skid mounted equipment, and other non-current carrying metallic parts of equipment shall be grounded to the ground grid per NEC.

1.02 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

1.03 REFERENCES

A. National Electrical Code (NEC) Article 250

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. A resistance of not greater than 25 ohms shall be provided, unless otherwise specified. Ground resistances shall be measured as herein described. Resistances of systems requiring separate ground rods, rather than a counterpoise, shall be measured separately before bonding below grade. The combined ground resistance of separate systems bonded together below grade may be used to meet the specified ground resistance, but the minimum number of rods indicated must still be provided.

2.02 GROUND RODS

A. Ground rods shall be copper-clad steel conforming to UL 467, 3/4 inch in diameter by 10 feet in length. Unless otherwise indicated, ground rods shall be driven into the ground until tops of rods are approximately 6 inches below finished grade. In counterpoise systems, tops of ground rods shall be approximately at elevations of counterpoises. Where the specified ground resistance cannot be met with the indicated number of ground rods, additional ground rods, longer ground rods, or deep-driven sectional rods shall be installed and connected until the specified resistance is obtained, except that not more than three additional ground rods shall be required at any one installation. Ground rods shall be spaced as evenly as possible at least 10 feet apart and 10 feet from structures. Connections shall be made below grade. Contractor shall install a minimum of two ground rods unless more are specified

2.03 CONNECTIONS

A. Connections above grade shall be made with bolted solderless connectors, and those below grade shall be made by a fusion-welding process. In lieu of a fusion-welding process, a compression ground grid connector of a type which uses a hydraulic

compression tool to provide the correct circumferential pressure may be used. Tools and dies shall be as recommended by the manufacturer. An embossing die code or other standard method shall provide visible indication that a connector has been adequately compressed on the ground wire.

2.04 GROUNDING ELECTRODE CONDUCTOR

A. Service entrance grounding electrode conductors shall be sized in accordance with NEC Table 250.66, unless otherwise indicated on the Plans. After being located to provide maximum physical protection, exposed ground wires shall be securely attached to structural supports at not more than 2-foot intervals with suitable fasteners. Bends greater than 45 degrees in ground wires are not permitted. Routing of ground conductors through concrete should be avoided, except where specifically called for in these Documents. When concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit, so as to provide an opening for the ground wire. The opening shall be sealed with a suitable compound after installation of the ground wire.

2.05 EQUIPMENT GROUNDING CONDUCTOR

A. Neutral conductors shall be grounded where indicated. Equipment grounding conductors shall be sized in accordance with NEC Table 250.122, unless otherwise indicated. Ground wires shall be protected by conduit, where such wires run exposed above grade in non-fence enclosed areas, or are run through concrete construction. Where concrete penetration is necessary, nonmetallic conduit shall be cast flush with the points of concrete entrance and exit, so as to provide an opening for the ground wire. The opening shall be sealed with a suitable compound after installation of the ground wire. Bends greater than 45 degrees in ground wire connections to the ground rods, or counterpoises are not permitted.

2.06 EQUIPMENT GROUNDING

A. Equipment frames of motor housings, equipment skids, metallic tanks, metallic equipment enclosures, metal splicing boxes, chain-link fencing, and other metallic non-current carrying metal items, shall be grounded. Connections to earth shall be made in the same manner as required for system grounding.

2.07 SURGE ARRESTER GROUNDING

A. Surge arresters shall be grounded. Resistance to ground for intermediate-class arresters shall be not more than 10 ohms and for distribution-class arresters shall be not more than 25 ohms. Ground wire connections shall be not less than No. 4 AWG for distribution arresters and No. 1/0 AWG for intermediate arresters. Connections to earth shall be made in the same manner as required for neutral conductors. Surge arrester grounds may use the same ground wires provided for equipment operating at more than 750 volts. Surge arrester and secondary neutral grounds shall be separate from and independent of each other.

2.08 LIGHTING POLE GROUNDING

A. Base of lighting poles shall be connected to an adjacent ground rod as indicated on Plans. A ground connection from poles back to neutral ground points shall also be provided utilizing equipment grounding conductor.

2.09 METALLIC STRUCTURES

A. Metallic structures and buildings shall be grounded per NEC.

2.10 GROUNDING RINGS

A. When required, grounding rings shall be installed using bare copper cable with ground rods at a maximum of 25 feet intervals using thermoweld connecting means as indicated on Plans in accordance with NEC requirements. Ring shall be located a minimum of 10' from the building.

2.11 CONCRETE ENCASED ELECTRODE

A. Two Concrete Encased Electrodes shall be installed in all new structures whether specified on the plans or not. Concrete Encased Electrodes shall be installed using bare copper cable bonded to the rebar. Conductor shall be located in the footings of the building and installed in conformance with NEC requirements. If unspecified on the plans the cable length shall be 60 feet each and shall be bonded in at least 6 locations.

PART 3 - EXECUTION

3.01 INSTALLATION

A. It is the intent of these Contract Documents that all device and equipment grounds shall be run as a separate conductor in the conduit from the equipment to the distribution panels or system ground. Wireways and enclosures shall be properly bonded and grounded, and ground conductors shall be run for all circuits.

B. Equipment cases and devices shall be grounded. Ground rods shall be driven, and concrete encased conduits installed, before a building, or structure is built, and ground conductors brought through the concrete to accessible points for grounding equipment. These systems shall be installed at each structure, where transformers, switchboards, panelboards, and MCC's are installed.

C. Ductbanks shall contain a bare copper ground conductor. The system ground conductors shall run continuously in ductbanks, through handholes and other raceway boxes. The system ground shall be connected to the structure grounding systems to provide a continuous grounding system. Each metallic raceway, panel, switchboard, and other metallic devices associated with the electrical and control systems shall be bonded to this grounding system.

D. Ground rods shall be installed not less than 6 inches below grade. Equipment, neutral, and surge arrester ground wires shall be connected to the ground grid as indicated.

3.02 TESTS

A. Pre-Energization Tests — Pre-energization tests shall include, but shall not be limited to tests required to perform under paragraph "GENERAL REQUIREMENTS." No part of the electrical system shall be energized until all station grounding system components have been tested and demonstrated to comply with the requirements specified, and until associated test reports have been submitted and approved.

B. Ground-Resistance Measurements — Ground-resistance measurements of each ground rod shall be taken and certified by the Contractor to the Engineer. No part of the electrical distribution system shall be energized prior to the resistance testing of that system's ground rods and grounding system and submission of test results to the Engineer. Test

reports shall indicate the location of the ground rod and grounding system and the resistance and the soil conditions at the time the test was performed. When the building water service is used as a ground or part of the grounding system, ground-resistance measurements shall also be made of this connection. Ground-resistance measurements shall be made in normally dry weather, not less than 48 hours after rainfall, and with the ground under test isolated from other grounds. The resistance to ground shall be measured using the fall-of-potential method described in IEEE Std 142 and Std 81.

3.03 TEST RESULTS

A. The Contractor shall perform the above tests and submit a certified test report prior to energizing the equipment.

END OF SECTION 16170

SECTION 16190 - SUPPORTING DEVICES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Supports, anchors, sleeves, and seals, are indicated on the Plans, schedules, and specified in other sections of these Specifications.

B. Types of supports, anchors, sleeves and seals specified in this section include the following:

1. One-hole Conduit Straps
2. One-Hole Conduit Straps with Clamp Backs
3. Two-Hole Conduit Straps
4. Conduit Hangers
5. I-beam Clamps
6. Channel Clamps
7. Round Steel Rods
8. Drop-in Anchors
9. Wedge Type Anchor Bolts
10. Lead Expansion Anchors
11. Toggle Bolts
12. Wall and Floor Seals
13. Cable Supports
14. U-Channel Strut System
15. Sleeves

1.02 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following: Abbeon Cal Inc., Ackerman Johnson Fastening Systems Inc., Elcen Metal Products Co., Ideal Industries, Inc., Josyln Mfg and Supply Co., McGraw Edison Co., Rawlplug Co. Inc., Star Expansion Co., U.S. Expansion Bolt Co., Allied Tube and Conduit Corp., B-Line Systems, Inc., Greenfield Mfg Co., Inc., Midland-Ross Corp., O-Z/Gedney Div; General Signal Corp., Power-Strut Div.; Van Huffel Tube Corp., and Unistrut Div; GTE Products Corp., and Robroy Industries.

2.02 GENERAL

A. Provide supporting devices that comply with manufacturer standard materials, design, and construction, in accordance with published product information, and as required for complete installations, and as specified herein.

2.03 SUPPORTS

A. Provide supporting devices of types, sizes, and materials indicated, and having the following construction features:

1. One-Hole Conduit Straps: For supporting electrical metallic tubing, and liquid tight flexible conduit; zinc plated steel, stainless steel or galvanized steel; snap-on, heavy duty.
2. One-Hole Conduit Straps with Clamp Backs: For supporting rigid metal conduit, and intermediate metal conduit; cast galvanized steel.
3. Two-Hole Conduit Straps: For supporting electrical metallic tubing, rigid metal conduit, and intermediate metal conduit; zinc plated steel, stainless steel or galvanized steel.
4. Conduit Hangers: For supporting electrical metallic tubing, rigid metal conduit, and intermediate metal conduit; zinc plated steel, stainless steel or galvanized steel.
5. I-Beam Clamps: Electroplated zinc or hot dipped galvanized malleable iron.
6. Channel Clamps: Electroplated zinc or hot dipped galvanized steel.
7. Round Steel Rod: National coarse thread, electroplated.

2.04 ANCHORS

A. Provide anchors of types, sizes, and materials indicated, with the following construction features:

1. Lead Expansion Anchors: For CMU walls, 1/4”-20 threads, set tool required.
2. Toggle Bolts: Electroplated steel, size as required.
3. Drop-in Anchors: Stainless steel, size as required.
4. Anchor Bolts: Stainless steel, size as required.
5. Lag Bolts: Stainless steel, size as required.
6. Half-round head, non-removable anchor bolts shall not be used.
7. Self-Tapping screws shall not be used.

2.05 SEALS

A. Provide seals of types, sizes and materials indicated; with the following construction features:

1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sized indicated; suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
2. Conduit sealing bushings shall be manufactured by O-Z/Gedney, Model CSMI, or equal.
3. The conductor sealing bushings shall be manufactured by O-Z/Gedney, Model CSBG, or equal.

2.06 CONDUIT CABLE SUPPORTS

A. Provide cable supports with insulating wedging plug for non-armored type electrical cables in risers; construct 2" rigid metal conduit; 3-wires, type wire as indicated; construct body of malleable-iron casting with hot-dip galvanized finish.

2.07 U-CHANNEL STRUT SYSTEM

A. Provide U-channel strut system for supporting electrical equipment, 12-gage hot-dip galvanized steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with the following fittings that mate and match with U-Channel:
   1. Fixture hangers
   2. Channel hangers
   3. End caps
   4. Beam clamps
   5. Wiring stud
   6. Thinwall conduit clamps
   7. Rigid conduit clamps
   8. Post Bases
   9. U-bolts

B. Approved for use with the following types of conduit:
   1. EMT
   2. IMT
   3. GRS
   4. PVC (where above conduits are approved for the same location.)

2.08 PIPE SLEEVES

A. Provide pipe sleeves from the following:

   1. Steel Pipe: Fabricate from Schedule 40 galvanized steel pipe; remove burrs.

2.09 PVC COATED U-CHANNEL STRUT SYSTEM

A. Provide PVC Coated U-channel strut system for supporting electrical equipment, 20 mil PVC coated steel, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with all Stainless Steel hardware, and the following fittings that mate and match with PVC Coated U-Channel:

   1. PVC Coated Strut nut
   2. PVC Coated Pipe straps
   3. Touch up compound (Gray)

B. Approved for use with the following types of conduit:

   1. PVC Coated GRS
   2. Aluminum
   4. PVC

2.10 STAINLESS STEEL U-CHANNEL STRUT SYSTEM

A. Provide Stainless Steel U-channel strut system for supporting electrical equipment, of types and sizes indicated; construct with 9/16" dia. holes, 8" o.c. on top surface, with all stainless steel hardware, and the following stainless steel fittings that mate and match with Stainless Steel U-Channel:

   1. Fixture hangers
   2. Channel hangers
   3. End caps
   4. Beam clamps
   5. Wiring stud
   6. Post bases

7. Rigid conduit clamps
8. U-bolts

B. Approved for use with the following types of conduit:

1. PVC Coated GRS
2. PVC

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install hangers, anchors, sleeves and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.

B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.

C. Install hangers, supports, clamps and attachments to support piping properly from building structure. Arrange for grouping of 2 or more parallel runs of conduits to be supported together on channel type hangers where possible. Install supports with spacing indicated and in compliance with NEC requirements.

D. Torque sleeve seal nuts, complying with manufacturer recommended values. Ensure that sealing grommets expand to form watertight seal.

E. Comply with manufacturer’s recommendations for touch up of field cut ends or damaged PVC coated U-channel and fittings.

F. Remove burrs and apply a cold zinc galvanizing paint to field cut galvanized U-channel strut prior to installation.

G. Provide a minimum of two anchors per piece of u-channel. Maximum spacing of anchors shall be 12”.

END OF SECTION 16190

SECTION 16195 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Electrical identification work specified in this section covers the following:

1. Buried cable warnings
2. Electrical power, control and communication conductors
3. Operational instructions and warnings
4. Danger signs
5. Equipment/system identification signs
6. Conduit
7. Instruments and Enclosures

1.02 SUBMITTALS

A. Submittals shall include the following:

1. Manufacturers data on electrical identification materials and products
2. Samples of each color, lettering style and other graphic representation required for each identification material or system
3. Table or list of equipment, panel, and disconnect switch labels

1.03 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering electrical identification products maybe incorporated in the work include, but not limited to, the following:

1. Brady, W.H. Co.
2. Ideal Industries, Inc.
3. Panduit Corp.
4. or, equal

1.04 QUALITY COMPLIANCE

A. Comply with applicable requirements of UL Std. 969, "Marking and Labeling Systems", pertaining to electrical identification systems.

B. Comply with applicable requirements of NEMA Std. WC-1 and WC-2 pertaining to identification of power and control conductors.

PART 2 - PRODUCTS

2.01 GENERAL

A. Except as otherwise indicated, provide manufacturer standard products of categories and types required for each application. Where more than single type is specified for an application, selection is Installer's option. Installer should maintain a consistent selection for each application.

2.02 COLOR-CODED CONDUIT MARKERS

A. Provide manufacturer's standard pre-printed, flexible or semi-rigid, permanent, plastic-sheet conduit markers, extending 360 degrees around conduits; designed for attachment

to conduit by adhesive, adhesive lap joint of marker, cable tie, matching adhesive plastic tape at each end of marker, or pre-tensioned snap-on. Except as otherwise indicated, provide lettering that indicates voltage of conductor(s) in conduit. Provide 8" minimum length for 2" and smaller conduit, 12" length for larger conduit.

B. Unless otherwise indicated or required by governing regulations, provide white markers with black letters.

C. Each end of conduits should be marked where the conduit enters and enclosure or junction of more than two conduits.

2.03 CABLE AND CONDUCTOR WIRE MARKERS

A. Cable and conductor wire markers shall be self laminating vinyl on white background, printed using a Brady TLS2200 printer, Seton printer, or equal. Handwritten wire markers are not acceptable.

B. Heat shrink tubing, or sleeve type wire markers are also acceptable. Markers shall be printed not hand written.

2.04 SELF-ADHESIVE PLASTIC SIGNS

A. Provide manufacturer's standard, self-adhesive or pressure-sensitive, pre-printed, flexible vinyl signs for operational instructions or warnings; of sizes suitable for application areas and adequate for visibility, with proper wording for each application, e.g., 208V, EXHAUST FAN, RECTIFIER.

B. Unless otherwise indicated or required by governing regulations, provide white signs with black lettering.

C. Where approved by engineer engraved stainless steel tags fastened with 18 gauge stainless steel wire may be attached to valves and isolated equipment.

2.05 LETTERING AND GRAPHICS

A. Coordinate names, abbreviations and other designations used in electrical identification work, with corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of electrical systems and equipment. Comply with ANSI A13.1 pertaining to minimum sizes for letters and numbers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install electrical identification products as indicated, in accordance with manufacturer's written instructions, and requirements of NEC.

B. Where identification is to be applied to surfaces that require finish, install identification after completion of painting.

C. Comply with governing regulations and requests of governing authorities for identification of electrical work.

D. Electrical identification shall contain identical markings on both ends of each conduit and cable. Identification shall be recorded on record drawings for both cables and conductors.

3.02 CONDUIT IDENTIFICATION

A. Where electrical conduit is exposed in spaces with exposed mechanical piping that is identified by a color-coded method, apply color-coded identification on electrical conduit in manner similar to piping identification. Except as otherwise indicated use white as coded color for conduit.

3.03 CABLE/CONDUCTOR IDENTIFICATION

A. Apply cable/conductor identification, including voltage, phase and feeder number, on each cable/conductor in each box/enclosure/cabinet where wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project's electrical work.

3.04 EQUIPMENT/SYSTEM IDENTIFICATION

A. Install engraved plastic-laminate sign on each piece of electrical equipment; including a general label for each major electrical system, including communication, control, and signal systems, unless unit is specified with its own self-explanatory identification or signal system. Except as otherwise indicated, provide single line of text, 1/2" high lettering on 1-1/2" high sign (2" high where 2 lines are required), black lettering in white field. Provide text matching terminology and numbering of the Contract Documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
   1. Panel boards, transformers, electrical cabinets and enclosures.
   2. Access panel/doors to electrical facilities.
   3. Major electrical switchgear.
   4. Motor Control Center(s).
   5. Service Entrace(s)

B. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with stainless steel screws, except use adhesive where screws should not or cannot penetrate the substrate. Provide signs as required by NEC for multiple services, or remo

C. Engraved three-layer laminated plastic, black letters on white background, unless otherwise specified by drawings or engineer shall be provided for the following equipment:
   1. TXs
   2. Disconnect switches
   3. Push button stations
   4. Control devices
   5. Instruments
   6. Motors
   7. All major pieces of process equipment
   8. Actuators
   9. Control valves
   10. Solenoid valves
   11. Any device relevant to the operation of the plant
   12. Communications enclosures
   13. Junction boxes

D. Stainless steel, 1/16" thick, with 1/8" stamped or engraved lettering, per Item C above. May be used in lieu of phenolic engraved nametags on instruments and valves as approved by the engineer. Tag shall be attached with #18 stainless steel wire.

3.05 CIRCUIT IDENTIFICATION

A. The 3-phase wires shall be identified at the switchgear, panelboards and motor control centers as Phases A, B, and C. At 277/480V, Phase A shall be brown, Phase B shall be orange, and Phase C shall be yellow. At 120/208V, Phase A shall be Black, Phase B shall be Red, and Phase C shall be Blue. The neutral shall be white.

B. In addition to color coding all conductors, each conductor shall be identified in each pull box, manhole, panelboard, cable tray, or termination with circuit identification markers. This identification is applicable to all power, control, alarm, and instrumentation conductors and these markings shall be recorded on the Record Documents. Markers shall be slip-on PVC sleeve type as manufactured by Brady, Seton, or equal.

C. Markers for other cabling shall be B-292 vinyl as manufactured by Brady, Seton, or equal.

D. Exposed medium voltage conduits shall be labeled at 50-foot intervals with 1-inch letters stating the voltage - example - "12,470 volts". Labels shall be vinyl plastic as manufactured by Brady, Seton, or equal.

3.06 AUTOMATIC EQUIPMENT WARNING SIGNS

A. Permanent warning signs shall be mounted at all mechanical equipment that may be started automatically or from remote locations. Signs shall be in accordance with OSHA regulations and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the Engineer.

B. Warning signs shall be 7 inches high by 10 inches wide, colored yellow and black, on not less than 18 gauge vitreous enameling stock. Sign shall read:

CAUTION
THIS EQUIPMENT STARTS
AUTOMATICALLY
BY REMOTE CONTROL

3.07 HIGH VOLTAGE WARNING SIGNS

A. Permanent and conspicuous warning signs shall be mounted on all equipment, doorways to equipment rooms, pull boxes, manholes, where the voltage exceeds 250 volts.

B. Signs shall be in accordance with OSHA regulation, and shall be suitable for exterior use. The warning signs shall be fastened with round head brass screws or bolts, located and mounted in a manner acceptable to the Engineer.

C. Signs shall be 7 inches high by 10 inches wide, colored red and white, on not less than 18 gauge vitreous enameling stock. Sign shall read:

WARNING
HIGH VOLTAGE
KEEP OUT

3.08 CONDUCTOR FASTENERS

A. Glue-on type conductor fasteners shall not be used in any panels, panelboards, switchboards, switchgear, motor control centers, or other enclosures containing electrical devices and/or conductors.

END OF SECTION 16195

SECTION 16475 - MINI POWER CENTERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This section covers electrical Mini Power Centers.

PART 2 - PRODUCTS

2.01 MINI POWER CENTERS

A. The contractor shall furnish and install Mini Power Centers, as indicated on the Electrical Plans.

B. Single phase transformers shall be 480 volt primary and 240/120 volt secondary. Three phase transformers shall be 480 volt primary and 208 Y/120 volt secondary.

C. All transformers shall have a minimum of 2-5% full capacity primary taps below normal and shall be rated 115 degree temperature rise above 40 degree maximum ambient. All insulating materials are to be in accordance with current ANSI C89.2 and NEMA ST20 standards for a 185 degree UL component recognized insulation system. Transformers are to be encapsulated using a sand-epoxy resin mixture to provide maximum protection against moisture, dust and corrosive environments.

D. Enclosures shall be cleaned, phosphatized and electrostatically powder coated and shall be UL Listed for indoor and outdoor use.

E. Mini Power Center Units shall include integrally mounted and wired primary and secondary main circuit breakers in accordance with National Electrical Code requirement. These breakers and all branch circuit breakers shall be bolt-on type and as specified elsewhere within these specifications. Minimum A/C rating shall be as indicated on Plans.

F. A hinged access door shall be provided which maintains itself in the open position when desired, and which has padlock provisions to prevent unauthorized entry. All live parts are to be fully enclosed for personnel protection when installation is completed. The transformer and panelboards shall be constructed with separate enclosures capable of being assembled or disassembled as independent units.

G. The Mini Power Centers shall be UL Listed for use as service equipment.

H. The Mini Power Centers shall be as manufactured by Square D Company or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Mini Power Centers shall be installed as indicated on the plans and per manufacturer's instruction.

END OF SECTION 16475

SECTION 16476 - LOW VOLTAGE CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install, low voltage circuit breakers, as indicated on the Drawings and specified herein.

1.02 SUBMITTALS

A. Products shall be submitted in accordance with Section 16000, and elsewhere in the Contract Documents, prior to installation.

1.03 QUALITY ASSURANCE

A. The breaker manufacturer's facilities shall be ISO 9001 certified.

PART 2 - PRODUCTS

2.01 GENERAL

A. Circuit breakers shall be as manufactured by Square D, Cutler-Hammer, Allen-Bradley, General Electric, or equal.

B. Circuit breaker frame, trip, short circuit, and interruption ratings shall be as indicated on the Drawings, except that they shall be coordinated with the ratings of the equipment actually furnished, and shall be modified where necessary to suit the equipment. Circuit breakers to be used in motor control centers shall be as indicated on the Drawings. Where no indication of type is given on the Drawings circuit breakers protecting motors shall be motor circuit protectors, and other circuit breakers shall be molded case type.

C. Circuit breaker for mounting in motor control centers, or for separate mounting shall be of the air-break type, quick-make and quick-break, 600 volt, with number of poles as indicated on the Drawings.

D. Each pole of the circuit breaker shall provide inverse time delay, and instantaneous circuit protection.

E. The breakers shall be operated by a handle, and shall have a switching mechanism that is mechanically trip free from the handle, so that the contacts cannot be held closed against short circuits, and abnormal currents. Tripping due to overload, or short circuit shall be clearly indicated by the handle automatically assuming a position between the manual ON and OFF positions. Latch surfaces shall be ground and polished. Poles shall be constructed so that they open, close, and trip simultaneously.

F. Breakers must be completely enclosed in a molded case. Non-interchangeable trip breakers shall have their covers sealed; interchangeable trip breakers shall have the trip unit sealed to prevent tampering. Ampere ratings shall be clearly visible. Contacts shall be non-welding silver alloy. Arc extinction must be accomplished by means of arc chutes. The minimum interrupting ratings of the circuit breakers shall be at least equal to the available short circuit current at the line terminals.

G. Circuit breakers shall conform to the applicable requirements of NEMA Standards Publication No. AB1.

H. Molded case circuit breakers shall be ambient temperature compensating that provides inverse time delay overload and instantaneous short circuit protection by means of a thermal magnetic element. Compensation shall be accomplished by a secondary bi-metal that will allow the breaker to carry rated current between 25 degrees C and 50 degrees C with tripping characteristics that are approximately the same throughout this temperature range.

I. On breakers with interchangeable, thermal, adjustable magnetic trip, the accessibility and position of the adjustment knob shall not be changed from those on the standard breaker.

J. Unless mounted in a switchboard, or panelboard, circuit breakers shall be housed in a NEMA rated enclosure as described elsewhere in these specifications.

K. Provide circuit breakers with shunt trip mechanisms where shown on the Drawings.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Circuit breakers shall be installed as indicated on the Drawings and per manufacturer's instructions.

END OF SECTION 16476

SECTION 16950 - ELECTRICAL TESTING

PART 1 – GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI):
   a. 450, Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generator Stations and Substations.
   b. C2, National Electric Safety Code.
   c. C37.20.1, Metal-Enclosed Low Voltage Power Circuit Breaker Switchgear.
   d. C37.20.2, Metal-Clad and Station-Type Cubicle Switchgear.
   e. C37.20.3, Metal-Enclosed Interrupter Switchgear.
   f. C62.33, Standard Test Specifications for Varistor Surge Protective Devices.
2. American Society for Testing and Materials (ASTM):
   a. D665, Standard Test Method for Rust Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water.
   b. D877, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
   c. D923, Standard Test Method for Sampling Electrical Insulating Liquids.
   d. D924, Standard Test Methods for A-Class Characteristics and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
   e. D971, Standard Test Method for Interfacial Tension of 0.1 against Water by the Ring Method.
   f. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.
   g. D1298, Standard Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
   h. D1500, Standard Test Method for ASTM Color of Petroleum Products.
   i. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Oils of Petroleum Origin in the Field.
   j. D1533, Standard Test Methods for Water in Insulating Liquids.
   k. D1816, Standard Test Method for Dielectric Breakdown Voltage on Insulating Oils of Petroleum Origin Using VDE Electrodes.
   l. D2285, Standard Test Method for Interfacial Tension of Electrical Insulating Oils of Petroleum Origin against Water by the Drop-Weight Method.
3. Institute of Electrical and Electronics Engineers (IEEE):
   a. 43, Recommended Practice for Testing Insulating Resistance of Rotating Machinery.
   b. 48, Standard Test Procedures and Requirements for High-Voltage Alternating-Current Cable Terminators.
   c. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
   d. 95, Recommended Practice for Insulation Testing of Large AC Rotating Machinery with High Direct Voltage.
   e. 118, Standard Test Code for Resistance Measurement.
   f. 400, Guide for Making High-Direct-Voltage Tests on Power Cable Systems in the Field.
4. National Electrical Manufacturers Association (NEMA):
   a. AB 4, Guideline for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
   b. PB 2, Deadfront Distribution Switchboards.
   c. WC 7, Cross-Linked-Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

d. WC 8, Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

5. International Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 70E, Standard for Electrical Safety Requirements for Employee Workplaces.

1.02 SUBMITTALS

A. Administrative Submittals: Submit 30 days prior to performing inspections or tests:

1. Schedule for performing inspection and tests.
2. List of references to be used for each test.
3. Sample copy of equipment and materials inspection form(s).
4. Sample copy of individual device test form.
5. Sample copy of individual system test form.

B. Quality Control Submittals: Submit within 14 days after completion of test:

1. Test or inspection reports and certificates for each electrical item tested.

C. Contract Closeout Submittals:

1. Operation and Maintenance Data:
   a. In accordance with references elsewhere in these specifications.
   b. After test of inspection reports and certificates have been reviewed by ENGINEER and returned, insert a copy of each in operation and maintenance manual.

1.03 QUALITY ASSURANCE

A. Test equipment shall have an operating accuracy equal to, or greater than, requirements established by NETA ATS.

B. Test instrument calibration shall be in accordance with NETA ATS.

1.04 SEQUENCING AND SCHEDULING

A. Perform inspection and electrical tests after equipment has been installed.

B. Perform tests with apparatus de-energized whenever feasible.

C. Inspection and electrical tests on energized equipment are to be:
1. Scheduled with OWNER prior to de-energization.
2. Minimized to avoid extended period of interruption to the operating plant equipment.

D. Notify OWNER at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 GENERAL

A. Tests specified in this section are to be performed in accordance with the requirements elsewhere in these specifications.

B. Tests and inspection shall establish that:

1. Electrical equipment is operational within industry and manufacturer's tolerances.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, and ANSI C2.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Adjust mechanisms and moving parts for free mechanical movement.

E. Adjust adjustable relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

F. Verify nameplate data for conformance to Contract Documents.

G. Realign equipment not properly aligned and correct un-levelness.

H. Properly anchor electrical equipment found to be inadequately anchored.

I. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench to manufacturer's recommendations, or as otherwise specified.

J. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

K. Provide proper lubrication of applicable moving parts.

L. Inform OWNER of working clearances not in accordance with NFPA 70.

M. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

N. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by OWNER, door and panel sections having dented surfaces.
5. Repair or replace, as determined by OWNER, poor fitting doors and panel sections.
6. Repair or replace improperly operating latching, locking, or interlocking devices.
7. Replace missing or damaged hardware.
8. Finish:
    a. Provide matching paint and touch up scratches and mars.
    b. If required due to extensive damage, as determined by OWNER, refinish the entire assembly.

O. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents.

3.02 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect Each Individual Exposed Power Cable No. 4 and Larger For:
   a. Physical damage.
   b. Proper connections in accordance with single-line diagram.
   c. Cable bends that do not conform with manufacturer's minimum allowable bending radius where applicable.
   d. Color coding conformance with specifications.
   e. Proper circuit identification.
2. Mechanical Connections For:
   a. Proper lug type for conductor material.
   b. Proper lug installation.
   c. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.
3. Shielded Instrumentation Cables For:
   a. Proper Shield grounding.
   b. Proper terminations.
   c. Proper circuit identification.
4 Control Cables For:
   a. Proper termination.
   b. Proper circuit identification.
5. Cables Terminated Through Window Type CTs: Verify that neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohm-meter dc voltage in accordance with NETA ATS, Table 10.2.
   b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
   c. Insulation resistance values equal to, or greater than ohm values established by manufacturer.
   d. Provide test reports to Engineer and Owner that show where test measurements were taken and the results
2. Contact Resistance Tests:
   a. Contact resistance in micro-ohms across each switch blade and fuse holder.
   b. Investigate deviation of 50% or more form adjacent poles or similar switches.

3.03 MOLDED CASE CIRCUIT BREAKERS

A. General: Inspection and testing limited to circuit breakers rated 400 amperes and larger.

B. Visual and Mechanical Inspection:

1. Proper mounting.
2. Proper conductor size.
3. Feeder designation according to nameplate and one-line diagram.
4. Cracked casings.
5. Connection bolt torque level in accordance with NETA ATS, Table 10.1.
6. Operate frame size and trip setting with circuit breaker schedules or one-line diagram.
7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. Utilize 1,000-volt dc megohm-meter for 480- and 600-volt circuit breakers.
   b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
   c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
   d. Test values to comply with NETA ATS, Table 10.2.
2. Contact Resistance Tests:
   a. Contact resistance in micro-ohms across each pole.
   b. Investigate deviation of 50% or more from adjacent poles and similar breakers.

3.06 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Visually Check Current, Potential, and Control Transformers for:
   a. Cracked insulation.
   b. Broken leads or defective wiring.
   c. Proper connections
   d. Adequate clearances between primary and secondary circuit wiring.
2. Verify Mechanically that:
   a. Grounding and shorting connections have good contact.
   b. Withdrawal mechanism and grounding operation, when applicable, operate properly.
3. Insulation resistance measurement on instrument transformer shall not be less than that shown in NETA ATS, Table 7.1.1.

3.07 METERING

A. Visual and Mechanical Inspection:

1. Verify meter connections in accordance with appropriate diagrams.
2. Verify meter multipliers.
3. Verify that meter types and scales conform to Contract Documents.
4. Check calibration of meters at cardinal points.
5. Check calibration of electrical transducers.

3.08 GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in motor control centers and panelboards assemblies for proper connection and tightness.
2. Ground bus connections in motor control centers and panelboards assemblies for proper termination and tightness.
3. Effective transformer core and equipment grounding.
4. Accessible connections to grounding electrodes for proper fit and tightness.
5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.
6. Test ground system using 3 point fall of potential test equipment. Ground system must provide less than 5 ohms to ground resistance. Provide test reports to Engineer and Owner that show where test measurements were taken and the results. System must be tested at all ground rods, concrete encased electrodes, ground busses and service entrance locations.

3.09 AC INDUCTION MOTORS

A. General: Inspection and testing limited to motors rated 10 hp and larger.

B. Visual and Mechanical Inspection:

1. Proper electrical and grounding connections.
2. Shaft alignment.
3. Blockage of ventilating air passageways.
4. Operate Motor and Check for:
   a. Excessive mechanical and electrical noise.
   b. Overheating.
   c. Correct rotation.
   d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for proper operation.
   e. Excessive vibration.
5. Check operation of space heaters.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 10.2 for:
      1) Motors above 200 hp for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
      2) Motors 200 hp and less for 1-minute duration with resistances tabulated at 30 and 60 seconds.
   b. Insulation resistance values equal to, or greater than, ohm values established by manufacturers.
2. Calculate polarization index ratios for motors above 200 hp. Investigate index ratios less than 1.5 for Class A insulation and 2.0 for Class B insulation.
3. Insulation resistance test on insulated bearings in accordance with manufacturer's instructions.
4. Measure running current and voltage, and evaluate relative to load conditions and nameplate full-load amperes.
5. Provide test reports to Engineer and Owner that show where test measurements were taken and the results

3.10 LOW VOLTAGE MOTOR CONTROL

A. Visual and Mechanical Inspection:

1. Proper barrier and shutter installation and operation.
2. Proper operation of indicating and monitoring devices.
3. Proper overload protection for each motor.
4. Improper blockage of air cooling passages.
5. Proper operation of draw out elements.
6. Integrity and contamination of us insulation system.
7. Check Door and Device Interlocking System By:
   a. Closure attempt of device when door is in OFF or OPEN position.
   b. Opening attempt of door when device is in ON or CLOSED position.
8. Check Nameplates for Proper Identification Of:
   a. Equipment title and tag number with latest one-line diagram.
   b. Pushbuttons.
   c. Control switches.
   d. Pilot lights.
   e. Control relays.
   f. Circuit breakers.
   g. Indicating meters.

9. Verify that fuse and circuit breaker sizes and types conform to Contract Documents.
10. Verify that current and potential transformer ratios conform to Contract Documents.
11. Check Bus Connections for High Resistance by Low Resistance Ohmmeter and Calibrated Torque Wrench Applied to Bolted Joints:
    a. Ohm value to be zero.
    b. Bolt torque level in accordance with NETA ATS, Table 10.1, unless otherwise specified by manufacturer.
12. Check Operation and Sequencing of Electrical and Mechanical Interlock Systems by:
    a. Closure attempt for locked open devices.
    b. Opening attempt for locked closed devices.
13. Verify performance of each control device and feature furnished as part of the motor control center.
14. Control Wiring:
    a. Compare wiring to local and remote control, and protective devices with elementary diagrams.
    b. Check for proper conductor lacing and bundling.
    c. Check for proper conductor identification.
    d. Check for proper conductor lugs and connections.
15. Exercise active components.
16. Inspect Contactors For:
    a. Correct mechanical operations.
    b. Correct contact gap, wipe, alignment, and pressure.
    c. Correct torque of all connections.
17. Compare overload heater rating with full-load current for proper size.
18. Compare fuse, motor protector, and circuit breaker with motor characteristics for proper size.
19. Perform phasing check on double-ended motor control centers to ensure proper bus phasing from each source.

B. Electrical Tests:

1. Insulation Resistance Tests:
    a. Applied megohm-meter dc voltage in accordance with NETA ATS, Table 10.2.
    b. Bus section phase-to-phase and phase-to-ground for 1 minute on each phase.
    c. Contactor phase-to-ground and across open contacts for 1 minute on each phase.
    d. Starter section phase-to-phase and phase-to-ground on each phase with starter contacts closed and protective devices open.
    e. Test values to comply with NETA ATS, Table 10.2.
2. Current Injection through Overload Unit at 300% of Motor Full-Load Current and Monitor Trip Time:
    a. Trip time in accordance with manufacturer's published data.
    b. Investigate values in excess of 120 seconds.
3. Control Wiring Tests:
    a. Apply secondary voltage to control power and potential circuits.
    b. Check voltage levels at each point on terminal boards and each device terminal.
    c. Insulation resistance test at 1,000 volts dc on control wiring except that connected to solid state components.
        1) Insulation resistance to be 1 megohm minimum.
4. Operational test by initiating control devices to affect proper operation.
5. Provide test reports to Engineer and Owner that show where test measurements were taken and the results

END OF SECTION 16950

APPENDIX A

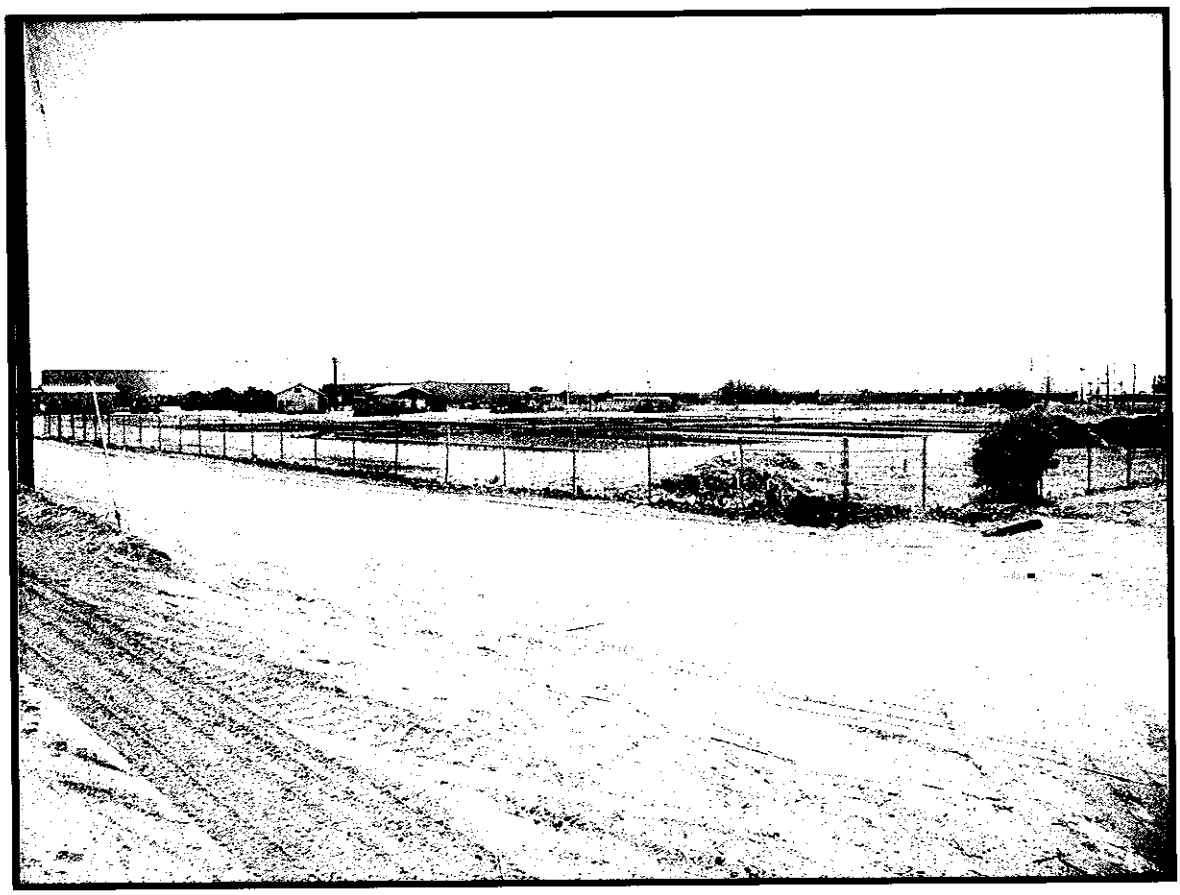
GEOTECHNICAL REPORT

Geotechnical Report

Imperial Wastewater Treatment Plant Upgrades
NEC 15th Street and North N Street
Imperial, California

Prepared for:

The Holt Group
1561 South 4th Street
El Centro, CA 92243



LANDMARK
Geo-Engineers and Geologists

Prepared by:

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April 2006

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April 28, 2006

Mr. Fernando Ramos
The Holt Group
1561 South 4th Street
El Centro, CA 92243

Geotechnical Investigation
Imperial WWTP Upgrades
NEC 15th Street and North N Street
Imperial, California
LCI Report No. LE06111

Dear Mr. Ramos:

This geotechnical report is provided for design and construction of the proposed improvements to the existing wastewater treatment plant located at the northeast corner of 15th Street and North N Street in northeast Imperial, California. Our geotechnical investigation was conducted in response to your request for our services. The enclosed report describes our soil engineering investigation and presents our professional opinions regarding geotechnical conditions at the site to be considered in the design and construction of the project.

This summary presents ***selected*** elements of our findings and recommendations only. It ***does not*** present crucial details needed for the proper application of our findings and recommendations. Our findings, recommendations, and application options are related ***only through reading the full report,*** and are best evaluated with the active participation of the engineer of record who developed them.

The findings of this study indicate that the site is, in general, predominantly underlain by medium stiff to sitff clays/silty clays of moderate expansion potential with 1 to 4 feet thick interbedded clayey silt and sandy silt layers between depths of 11 to 18 and 31 to 47 feet below ground surface.

The soil is highly corrosive to metals and may contain sufficient sulfates and chlorides to require special concrete mixes (4,500 psi with a 0.45 maximum water cement ratio and Type V cement) and protection of embedded steel components when concrete is placed in contact with native soil.

Evaluation of liquefaction potential at the sites indicates that 1 to 2 feet thick, isolated, interbedded layers of silt/sandy silt at a depth between 11 to 13 and 17 to 18 feet may liquefy under seismically induced groundshaking; however, potential settlement of approximately ½ inch is not considered sufficient to require deep ground improvement or special foundations at the site. No mitigation will be required at this site. The base of the sewer lift station will be located below of the liquefiable layers (25 feet bgs). However, piping connections to the lift station should include provisions for differing settlement between the pipeline and the wet well shaft.

There is an 11 foot layer of non-liquefiable soils above any potentially liquefiable soil; therefore, it is unlikely that there will be rapid deformation or punching bearing failures of the surface soils should liquefaction occur.

Structural designs should be designed to limit differential movement and/or swell to less than one inch. Typically, structural flat plate mats, grade-beam reinforced foundations, and stiffened post-tensioned foundations supporting loads typical to commercial structures will limit differential movement to acceptable levels.

We did not encounter soil conditions that would preclude implementation of the proposed project provided the recommendations contained in this report are implemented in the design and construction of this project.

We appreciate the opportunity to provide our findings and professional opinions regarding geotechnical conditions at the site. If you have any questions or comments regarding our findings, please call our office at (760) 370-3000.

Respectfully Submitted,
Landmark Consultants, Inc.

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Section 1
INTRODUCTION

1.1 Project Description

This report presents the findings of our geotechnical investigation for the proposed improvements to the existing wastewater treatment plant located at the northeast corner of 15th Street and North N Street in northeast Imperial, California (See Vicinity Map, Plate A-1). The proposed improvements will consist of the construction of a 1.0 MGD (million gallons per day) Biolac treatment lagoon, two lift stations, a helical sieve for influent screening, a second UV light disinfection channel, two additional sludge drying beds, and associated control buildings. A site plan for the proposed development was provided by the client prior to initiation of the field investigation.

Site development will include building pad preparation, Biolac lagoon and sludge drying beds excavation and embankment construction, underground utility installation, and excavation of two wet wells with an approximate depth of 25 feet.

1.2 Purpose and Scope of Work

The purpose of this geotechnical study was to investigate the upper 15 to 50 feet of subsurface soil at selected locations within the site for evaluation of physical/engineering properties. From the subsequent field and laboratory data, professional opinions were developed and are provided in this report regarding geotechnical conditions at this site and the effect on design and construction. The scope of our services consisted of the following:

- Field exploration and in-situ testing of the site soils at selected locations and depths.
- Laboratory testing for physical and/or chemical properties of selected samples.
- Review of the available literature and publications pertaining to local geology, faulting, and seismicity.
- Engineering analysis and evaluation of the data collected.
- Preparation of this report presenting our findings, professional opinions, and recommendations for the geotechnical aspects of project design and construction.

This report addresses the following geotechnical issues:

- Subsurface soil and groundwater conditions
- Site geology, regional faulting and seismicity, near source factors, and site seismic accelerations
- Liquefaction potential and its mitigation
- Expansive soil and methods of mitigation
- Aggressive soil conditions to metals and concrete

Professional opinions with regard to the above issues are presented for the following:

- Site grading and earthwork
- Building pad and foundation subgrade preparation
- Allowable soil bearing pressures and expected settlements
- Concrete slabs-on-grade
- Lateral earth pressures
- Excavation conditions and buried utility installations
- Mitigation of the potential effects of salt concentrations in native soil to concrete mixes and steel reinforcement
- Seismic design parameters

Our scope of work for this report did not include an evaluation of the site for the presence of environmentally hazardous materials or conditions.

1.3 Authorization

Mr. James G. Holt of The Holt Group provided authorization by written agreement to proceed with our work on March 24, 2006. We conducted our work according to our written proposal dated March 24, 2006.

Section 2
METHODS OF INVESTIGATION

2.1 Field Exploration

Subsurface exploration was performed on April 4, 2006 using Holguin, Fahan, & Associates, Inc. of Cypress, California to advance one (1) electric cone penetrometer (CPT) sounding to an approximate depth of 50 feet below existing ground surface. The sounding was made at the location shown on the Site and Exploration Plan (Plate A-2). The approximate sounding location was established in the field and plotted on the site map by sighting to discernable site features.

CPT soundings provide a continuous profile of the soil stratigraphy with readings every 2.5cm (1 inch) in depth. Direct sampling for visual and physical confirmation of soil properties has been used by our firm to establish direct correlations with CPT exploration in this geographical region.

The CPT exploration was conducted by hydraulically advancing an instrumented Hogentogler $10cm^2$ conical probe into the ground at a rate of 2cm per second using a 23-ton truck as a reaction mass. An electronic data acquisition system recorded a nearly continuous log of the resistance of the soil against the cone tip (Qc) and soil friction against the cone sleeve (Fs) as the probe was advanced. Empirical relationships (Robertson and Campanella, 1989) were then applied to the data to give a continuous profile of the soil stratigraphy. Interpretation of CPT data provides correlations for SPT blow count, phi (ϕ) angle (soil friction angle), undrained shear strength (S_u) of clays and over-consolidation ratio (OCR). These correlations may then be used to evaluate vertical and lateral soil bearing capacities and consolidation characteristics of the subsurface soil.

Additional subsurface exploration was performed on April 4, 2006 using 2R Drilling of Ontario, California to advance two (2) borings to depths of 16.5 to 29 feet below existing ground surface. The borings were advanced with a truck-mounted, CME 55 drill rig using 8-inch diameter, hollow-stem, continuous-flight augers. The approximate boring locations were established in the field and plotted on the site map by sighting to discernable site features. The boring locations are shown on the Site and Exploration Plan (Plate A-2).

A staff engineer observed the drilling operations and maintained a log of the soil encountered and sampling depths, visually classified the soil encountered during drilling in accordance with the Unified Soil Classification System, and obtained drive tube and bulk samples of the subsurface materials at selected intervals. The drill rig was equipped with a CME automatic hammer for conducting Standard Penetration Tests (SPT) in accordance with ASTM D1586. Relatively undisturbed soil samples were retrieved using a 2-inch outside diameter (OD) split-spoon sampler or a 3-inch OD Modified California Split-Barrel (ring) sampler. The samples were obtained by driving the sampler ahead of the auger tip at selected depths. The number of blows (N values) of a 140-lb. hammer falling 30 inches to drive the sampler 18 inches into undisturbed soil were recorded in 6-inch increments. Blow counts reported on the boring logs represent the field blow counts. No corrections have been applied for overburden pressure, automatic hammer drive energy, drill rod lengths, liners, and sampler diameter. Pocket penetrometer readings were also obtained to evaluate the stiffness of cohesive soils retrieved from sampler barrels.

After logging and sampling the soil, the exploratory borings were backfilled with the excavated material. The backfill was loosely placed and was not compacted to the requirements specified for engineered fill.

The subsurface boring logs and interpretive log of the CPT sounding are presented on Plates B-1 through B-3 in Appendix B. A key to the interpretation of CPT sounding and the boring logs are presented on Plates B-4 and B-5, respectively. The stratification lines shown on the subsurface logs represent the approximate boundaries between the various strata. However, the transition from one stratum to another may be gradual over some range of depth.

2.2 Laboratory Testing

Laboratory tests were conducted on selected bulk (auger cuttings) and relatively undisturbed soil samples obtained from the soil boring to aid in classification and evaluation of selected engineering properties of the site soils. The tests were conducted in general conformance to the procedures of the American Society for Testing and Materials (ASTM) or other standardized methods as referenced below. The laboratory testing program consisted of the following tests:

- Plasticity Index (ASTM D4318) – used for soil classification and expansive soil design criteria
- Particle Size Analyses (ASTM D422) – used for soil classification and liquefaction evaluation
- Unit Dry Densities (ASTM D2937) and Moisture Contents (ASTM D2216) – used for insitu soil parameters
- Chemical Analyses (soluble sulfates & chlorides, pH, and resistivity) (Caltrans Methods) – used for concrete mix evaluations and corrosion protection requirements.

The laboratory test results are presented on the subsurface logs in Appendix B and on Plates C-1 and C-2 in Appendix C.

Engineering parameters of soil strength, compressibility and relative density utilized for developing design criteria provided within this report were either extrapolated from correlations with the subsurface CPT data or from data obtained from the field and laboratory testing program.

Section 3
DISCUSSION

3.1 Site Conditions

The Imperial Wastewater Treatment Plant facility is rectangular in plan view and is located at the northeast corner of 15th Street and North N Street in northeast Imperial, California. The proposed 1.0 MGD Biolac lagoon will be located at the west side of the plant, north of the existing Aeration Basin No. 2 and west of the existing sludge drying beds. The proposed area for the Biolac lagoon is currently used as storage for pipe, concrete manholes, debris-soil piles and some equipment.

The two proposed sludge drying beds will be located at the northwest side of the wastewater plant between the north fence limit and the existing sludge drying beds. Some piles of sludge material cover the proposed drying beds site. The proposed sites for the two lift stations will be located east of the existing Aeration Basin No. 2 (Lift Station No. 1) and east of the proposed 1.0 MGD Biolac Lagoon (Lift Station No. 2).

Clarifiers, headwork pumping station and control buildings are located at the south side of the plant. Existing underground power lines and raw water supply lines cross the wastewater plant in east to west and north to south directions.

Adjacent properties are flat-lying and are approximately at the same elevation with this site. The Imperial Public Works maintenance yard and a 2.0 MG above ground steel water storage tank lies to the south side of the site. The P Street (dirt) and the Date Canal are located along the east side of the project site, followed by agricultural lands. The Union Pacific Railroad tracks are located along the west side of the project site, with the Imperial Irrigation District Headquarters beyond. Vacant lots (recently graded Morningside Subdivision) lie to the north of the project site.

The project site lies at an elevation of approximately 60 feet below mean sea level (MSL) (El. 940 local datum) in the Imperial Valley region of the California low desert. The surrounding properties lie on terrain which is flat (planar), part of a large agricultural valley, which was previously an ancient lake bed covered with fresh water to an elevation of 43± feet above MSL. Annual rainfall in this arid region is less than 3 inches per year with four months of average summertime temperatures above 100 °F. Winter temperatures are mild, seldom reaching freezing.

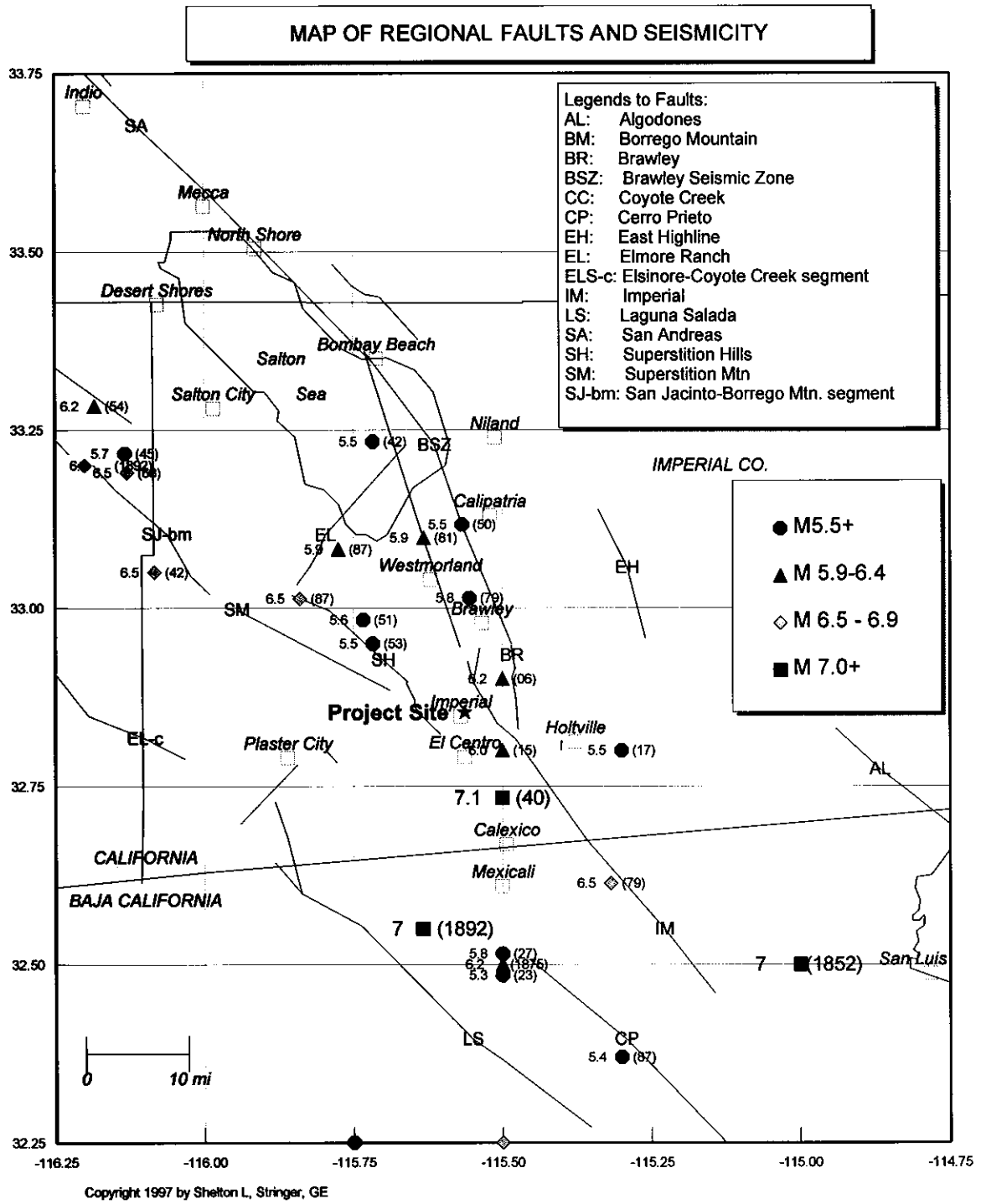
3.2 Geologic Setting

The project site is located in the Imperial Valley portion of the Salton Trough physiographic province. The Salton Trough is a topographic and geologic structural depression resulting from large scale regional faulting. The trough is bounded on the northeast by the San Andreas Fault and Chocolate Mountains and the southwest by the Peninsular Range and faults of the San Jacinto Fault Zone. The Salton Trough represents the northward extension of the Gulf of California, containing both marine and non-marine sediments since the Miocene Epoch. Tectonic activity that formed the trough continues at a high rate as evidenced by deformed young sedimentary deposits and high levels of seismicity. Figure 1 shows the location of the site in relation to regional faults and physiographic features.

The Imperial Valley is directly underlain by lacustrine deposits, which consist of interbedded lenticular and tabular silt, sand, and clay. The Late Pleistocene to Holocene lake deposits are probably less than 100 feet thick and derived from periodic flooding of the Colorado River which intermittently formed a fresh water lake (Lake Cahuilla). Older deposits consist of Miocene to Pleistocene non-marine and marine sediments deposited during intrusions of the Gulf of California. Basement rock consisting of Mesozoic granite and Paleozoic metamorphic rocks are estimated to exist at depths between 15,000 - 20,000 feet.

3.3 Seismicity and Faulting

Faulting and Seismic Sources: We have performed a computer-aided search of known faults or seismic zones that lie within a 62 mile (100 kilometers) radius of the project site as shown on Figure 1 and Table 1. The search identifies known faults within this distance and computes deterministic ground accelerations at the site based on the maximum credible earthquake expected on each of the faults and the distance from the fault to the site. The Maximum Magnitude Earthquake (Mmax) listed was taken from published geologic information available for each fault (CDMG OFR 96-08 and Jennings, 1994).



Faults and Seismic Zones from Jennings (1994), Earthquakes modified from Ellsworth (1990) catalog.

Figure 1. Map of Regional Faults and Seismicity

Table 1
FAULT PARAMETERS & DETERMINISTIC
ESTIMATES OF PEAK GROUND ACCELERATION (PGA)

Fault Name or Seismic Zone	Distance (mi) & Direction from Site	Fault Type		Fault Length (km)	Maximum Magnitude Mmax (Mw)	Avg Slip Rate (mm/yr)	Avg Return Period (yrs)	Date of Last Rupture (year)	Largest Historic Event >5.5M (year)	Est. Site PGA (g)
Reference Notes: (1)		(2)	(3)	(2)	(4)	(3)	(3)	(3)	(5)	(6)
Imperial Valley Faults										
Imperial	2.2 NE	A	B	62	**7.0**	20	79	1979	7.0 1940	**0.54**
Brawley	5.1 E	B	B	14	**7.0**	20	---	1979	5.8 1979	**0.39**
Brawley Seismic Zone	6.3 N	B	B	42	**6.4**	25	24		5.9 1981	**0.25**
East Highline Canal	19 ENE	C	C	22	**6.3**	1	774			**0.11**
Cerro Prieto	25 SSE	A	B	116	**7.2**	34	50	1980	7.1 1934	**0.15**
San Jacinto Fault System										
- Superstition Hills	3.1 SW	B	A	22	**6.6**	4	250	1987	6.5 1987	**0.39**
- Superstition Mtn.	7.5 WNW	B	A	23	**6.6**	5	500	1440 +/-		**0.25**
- Elmore Ranch	20 WNW	B	A	29	**6.6**	1	225	1987	5.9 1987	**0.12**
- Borrego Mtn	27 WNW	B	A	29	**6.6**	4	175		6.5 1942	**0.10**
- Anza Segment	43 NW	A	A	90	**7.2**	12	250	1918	6.8 1918	**0.10**
- Coyote Creek	46 WNW	B	A	40	**6.8**	4	175	1968	6.5 1968	**0.07**
- Hot Spgs-Buck Ridge	58 NW	B	A	70	**6.5**	2	354		6.3 1937	**0.05**
- Whole Zone	7.5 WNW	A	A	245	**7.5**	---	---			**0.41**
Elsinore Fault System										
- Laguna Salada	20 WSW	B	B	67	**7.0**	3.5	336		7.0 1891	**0.15**
- Coyote Segment	28 W	B	A	38	**6.8**	4	625			**0.11**
- Julian Segment	51 W	A	A	75	**7.1**	5	340			**0.08**
- Earthquake Valley	52 WNW	B	A	20	**6.5**	2	351			**0.06**
- Whole Zone	28 W	A	A	250	**7.5**	---	---			**0.16**
San Andreas Fault System										
- Coachella Valley	36 NNW	A	A	95	**7.4**	25	220	1690+/-	6.5 1948	**0.12**
- Whole S. Calif. Zone	36 NNW	A	A	458	**7.9**	---	---	1857	7.8 1857	**0.16**

Notes:

1. Jennings (1994) and CDMG (1996)
2. CDMG (1996), where Type A faults -- slip rate >5 mm/yr and well constrained paleoseismic data
   Type B faults -- all other faults.
3. WGCEP (1995)
4. CDMG (1996) based on Wells & Coppersmith (1994)
5. Ellsworth Catalog in USGS PP 1515 (1990) and USBR (1976), Mw = moment magnitude,
6. The deterministic estimates of the Site PGA are based on the attenuation relationship of:
   Boore, Joyner, Fumal (1997)

Seismic Risk: The project site is located in the seismically active Imperial Valley of southern California and is considered likely to be subjected to moderate to strong ground motion from earthquakes in the region. The proposed site structures should be designed in accordance with the California Building Code (CBC) for a "Design Basis Earthquake" (DBE) and with the appropriate near-source factors. The DBE is defined as the motion having a 10 percent probability of being exceeded in 50 years.

Seismic Hazards.

- **Groundshaking.** The primary seismic hazard at the project site is the potential for strong groundshaking during earthquakes along the Imperial, Brawley, and Superstition Hills Faults. A further discussion of groundshaking follows in Section 3.4.
- **Surface Rupture.** The project site does not lie within a State of California, Alquist-Priolo Earthquake Fault Zone. Surface fault rupture is considered to be unlikely at the project site because of the well-delineated fault lines through the Imperial Valley as shown on USGS and CGS maps. However, because of the high tectonic activity and deep alluvium of the region, we cannot preclude the potential for surface rupture on undiscovered or new faults that may underlie the site.
- **Liquefaction.** Liquefaction is a potential design consideration because of underlying saturated sandy substrata. The potential for liquefaction at the sites is discussed in more detail in Section 3.7.

Other Secondary Hazards.

- **Landsliding.** The hazard of landsliding is unlikely due to the regional planar topography. No ancient landslides are shown on geologic maps of the region and no indications of landslides were observed during our site investigation.
- **Volcanic hazards.** The site is not located in proximity to any known volcanically active area and the risk of volcanic hazards is considered very low.
- **Tsunamis, seiches, and flooding.** The site does not lie near any large bodies of water, so the threat of tsunami, seiches, or other seismically-induced flooding is unlikely.
- **Expansive soil.** In general, much of the near surface soils in the Imperial Valley consist of silty clays and clays which are moderate to highly expansive. The expansive soil conditions are discussed in more detail in Section 3.5.

3.4 Site Acceleration and UBC Seismic Coefficients

Site Acceleration: Deterministic horizontal peak ground accelerations (PGA) from maximum probable earthquakes on regional faults have been estimated and are included in Table 1. Ground motions are dependent primarily on the earthquake magnitude and distance to the seismogenic (rupture) zone. Accelerations also are dependent upon attenuation by rock and soil deposits, direction of rupture and type of fault; therefore, ground motions may vary considerably in the same general area.

We have used the computer program FRISKSP (Blake, 2000) to provide a probabilistic estimate of the site PGA using the attenuation relationship of Boore, Joyner, and Fumal NEHRP D 250 (1997). The PGA estimate for the project site having a 10% probability of being exceeded in 50 years (return period of 475 years) is **0.85g**.

CBC Seismic Response Coefficients: The CBC seismic response coefficients are calculated from the near-source factors for Seismic Zone 4. The near-source factors are based on the distance from the fault and the seismic source type. The following table lists seismic and site coefficients (near source factors) determined by Chapter 16 of the 2001 CBC. ***This site lies about 3.5 km from a Type A fault and overlies S_D (stiff) soil.***

CBC Seismic Coefficients for Chapter 16 Seismic Provisions

CBC Code Edition	Soil Profile Type	Seismic Source Type	Distance to Critical Source	Near Source Factors		Seismic Coefficients	
				Na	Nv	Ca	Cv
2001	S_D (stiff soil)	A	3.5 km	1.35	1.80	0.59	1.15
Ref. Table	16-J	16-U	---	16-S	16-T	16-Q	16-R

3.5 Subsurface Soil

Subsurface soils encountered during the field exploration conducted on April 4, 2006 consist of dominantly stiff to very stiff clay/silty clay to a depth of 50 feet. Interbedded clayey silt and sandy silt layers of about 1 to 4 feet were encountered at a depth of 11 to 18 and 31 to 47 feet below ground surface. The subsurface logs (Plates B-1 through B-7) depict the stratigraphic relationships of the various soil types.

The native surface clays likely exhibit moderate swell potential (Expansion Index, EI = 51 to 110) when correlated to Plasticity Index tests (ASTM D4318) performed on the native clays. The clay is expansive when wetted and can shrink with moisture loss (drying).

3.6 Groundwater

A 15-foot long 2-inch diameter slotted PVC piezometer was installed at the west side of the Imperial Wastewater Plant. Groundwater was encountered in the piezometer at a depth of 10 feet, on April 24, 2006, three weeks after placement of the piezometer. Dewatering should be anticipated for wet well construction and piping installed below 10 feet in depth. There is uncertainty in the accuracy of short-term water level measurements, particularly in fine-grained soil. Groundwater levels may fluctuate with precipitation, irrigation of adjacent properties, drainage, and site grading. The referenced groundwater level should not be interpreted to represent an accurate or permanent condition. Our work scope did not include a groundwater surface mounding study resulting from applied landscape water.

3.7 Liquefaction

Liquefaction occurs when granular soil below the water table is subjected to vibratory motions, such as produced by earthquakes. With strong ground shaking, an increase in pore water pressure develops as the soil tends to reduce in volume. If the increase in pore water pressure is sufficient to reduce the vertical effective stress (suspending the soil particles in water), the soil strength decreases and the soil behaves as a liquid (similar to quicksand). Liquefaction can produce excessive settlement, ground rupture, lateral spreading, or failure of shallow bearing foundations.

Four conditions are generally required for liquefaction to occur:

(1) the soil must be saturated (relatively shallow groundwater);
(2) the soil must be loosely packed (low to medium relative density);
(3) the soil must be relatively cohesionless (not clayey); and
(4) groundshaking of sufficient intensity must occur to function as a trigger mechanism.

All of these conditions exist to some degree at these sites.

Methods of Analysis: Liquefaction potential at the project sites were evaluated using the 1997 NCEER Liquefaction Workshop methods. The 1997 NCEER methods utilize direct SPT blow counts or CPT cone readings from site exploration and earthquake magnitude/PGA estimates from the seismic hazard analysis. The resistance to liquefaction is plotted on a chart of cyclic shear stress ratio (CSR) versus a corrected blow count $N_{1(60)}$ or Qc_{1N}. ***A ground acceleration of 0.85g was used in the analysis with a 10.0 foot groundwater depth.***

Liquefaction induced settlements have been estimated using the 1987 Tokimatsu and Seed method. Fines content of liquefiable sands and silt increase the liquefaction resistance in that more cycles of ground motions are required to fully develop pore pressures. The CPT tip pressures (Qc) were adjusted to an equivalent clean sand pressure (Q_{ClNcs}). The adjusted tip pressures were converted to equivalent clean sand blow counts ($N_{1(60)cs}$) prior to calculating settlements. A computed factor of safety less than 1.0 indicates a liquefiable condition.

The soil encountered at the points of exploration included saturated silts that could liquefy during a CBC Design Basis Earthquake (7M – 0.68g) for a 10% risk in 50 years. Liquefaction can occur within 1 to 2 feet thick isolated silt layers between depths of 11 to 13 and 17 to 18 feet. The likely triggering mechanism for liquefaction appears to be strong groundshaking associated with the rupture of the Imperial, Superstition Hills, and Brawley Seismic Zone.

Liquefaction Effects: ***Based on empirical relationships, total induced settlements are estimated to be about ½ inch should liquefaction occur.*** The minimum differential settlement could be estimated to be on the order of one-half of the total settlement be used in the design. Based on research from Ishihara (1985) and Youd and Garris (1995) ground rupture or sand boil formation is unlikely because of the thickness of the overlying unliquefiable soil. Because of the depth of the liquefiable layers, wide area subsidence from soil overburden would be the expected effect of liquefaction rather than bearing capacity failure of the proposed structures. The relatively high fines content (>30%) within the potentially liquefiable layer will probably reduce pore water movement significantly, thereby stalling development of a "quick" soil condition.

Since the potentially liquefiable sandy soils are overlain by 11 feet of non-liquefying soil which resist groundwater movement, it is unlikely that the light structure loads planned are sufficient to result in liquefaction induced settlement greater than the surrounding land mass.

Mitigation: Based on an estimate of about ½ inch of liquefaction induced settlements, no mitigation is required at this project site.

Sewer Lift Station Site: No mitigation will be required at this site since the base of the sewer lift station (25 feet) will be located below of the liquefiable layers. However, piping connections to the lift station should include provisions for differing settlement between the pipeline and the wet well shaft. Increased slope within the last 20 feet to the wet well shaft and a series of flexible (rubber gasketed) joints near the wet well is believed appropriate to allow differential movement during a large seismic event.

Section 4
RECOMMENDATIONS

4.1 Site Preparation

Clearing and Grubbing: All surface improvements, debris or vegetation including grass, trees, and weeds on the site at the time of construction should be removed from the construction area. Root balls should be completely excavated. Organic strippings should be hauled from the site and not used as fill. Any trash, construction debris, concrete slabs, old pavement, landfill, and buried obstructions such as old foundations and utility lines exposed during rough grading should be traced to the limits of the foreign material by the grading contractor and removed under our supervision. Any excavations resulting from site clearing should be sloped to a bowl shape to the lowest depth of disturbance and backfilled under the observation of the geotechnical engineer's representative.

Building Pad Preparation: The exposed surface soil within the building pad/foundation areas should be removed to 30 inches below the building pad elevation or existing grade (whichever is lower) extending five feet beyond all exterior wall/column lines (including concreted areas adjacent to the building). Exposed subgrade should be scarified to a depth of 8 inches, uniformly moisture conditioned to 5 to 10% above optimum moisture content and recompacted to 85 to 90% of the maximum density determined in accordance with ASTM D1557 methods.

The native soil is suitable for use as engineered fill provided it is free from concentrations of organic matter or other deleterious material. The fill soil should be uniformly moisture conditioned by discing and watering to the limits specified above, placed in maximum 8-inch lifts (loose), and compacted to the limits specified above. Clay soil should not be compacted greater than 90% relative compaction because highly compacted soil will result in increased swelling.

If foundation designs are to be utilized which do not include provisions for expansive soil, an engineered building support pad consisting a minimum of 2.5 feet of granular soil (or to a minimum of 12 inches below the deepest footing), placed in maximum 8-inch lifts (loose), compacted to a minimum of 90% of ASTM D1557 maximum density at 2% below to 4% above optimum moisture, should be placed below the bottom of the slab.

Imported fill soil (if required) should have a Plasticity Index less than 25 and sulfates (SO_4) less than 3,000 ppm or non-expansive, granular soil meeting the USCS classifications of SM, SP-SM, or SW-SM with a maximum rock size of 3 inches and 5 to 35% passing the No. 200 sieve. The geotechnical engineer should approve imported fill soil sources before hauling material to the site. Imported granular fill should be placed in lifts no greater than 8 inches in loose thickness and compacted to a minimum of 90% of ASTM D1557 maximum dry density at optimum moisture ±2%.

In areas other than the building pad which are to receive area concrete slabs, the ground surface should be presaturated to a minimum depth of 24 inches and then scarified to 8 inches, moisture conditioned to a minimum of 5% over optimum, and recompacted to 83-87% of ASTM D1557 maximum density just prior to concrete placement.

Bedding and Backfill of Pipeline: Bedding provides lateral and bearing support to the pipe. The bedding and the backfill and their densification should conform to the "*Standard Specifications for Public Works Construction*" Sections 306-1.2.1 and 306-1.3.1 through 306-1.3.5 or other acceptable standard methods.

On-site soil free of debris, vegetation, and other deleterious matter may be suitable for use as utility trench backfill, but may be difficult to uniformly maintain at specified moistures and compact to the specified densities. Imported granular material is acceptable for backfill of utility trenches. Granular trench backfill used in building pad areas should be plugged with a solid (no clods or voids) 2-foot width of native clay soils at each end of the building foundation to prevent landscape water migration into the trench below the building. Pipe envelope/bedding should either be clean sand (Sand Equivalent SE>30) or crushed rock when encountering groundwater. Backfill soil within paved areas should be placed in layers not more that 6 inches in thickness and mechanically compacted to a minimum of 87% of the ASTM D1557 maximum dry density except for the top 12 inches of the trench which shall be compacted to at least 90%. Native backfill should only be placed and compacted after encapsulating buried pipes with suitable bedding and pipe envelope material. Pipe envelope/bedding should either be clean sand (Sand Equivalent SE>30) or crushed rock when encountering groundwater. Precautions should be taken in the compaction of the backfill to avoid damage to the pipes and structures.

Groundwater was encountered at a depth of 10 feet below ground surface on April 24, 2006. Running ground conditions should be anticipated which will likely require dewatering of trenches greater than about 10 feet deep.

Moisture Control and Drainage: The moisture condition of the building pad should be maintained during trenching and utility installation until concrete is placed or should be rewetted before initiating delayed construction. If soil drying is noted, a 2 to 3 inch depth of water may be used in the bottom of footings to restore footing subgrade moisture and reduce potential edge lift.

Adequate site drainage is essential to future performance of the project. Infiltration of excess irrigation water and stormwaters can adversely affect the performance of the subsurface soil at the site. Positive drainage should be maintained away from all structures (5% for 5 feet minimum across unpaved areas) to prevent ponding and subsequent saturation of the native clay soil. Gutters and downspouts may be considered as a means to convey water away from foundations. If landscape irrigation is allowed next to the building, drip irrigation systems or lined planter boxes should be used. The subgrade soil should be maintained in a moist, but not saturated state, and not allowed to dry out. Drainage should be maintained without ponding.

Observation and Density Testing: All site preparation and fill placement should be continuously observed and tested by a representative of a qualified geotechnical engineering firm. Full-time observation services during the excavation and scarification process is necessary to detect undesirable materials or conditions and soft areas that may be encountered in the construction area. The geotechnical firm that provides observation and testing during construction shall assume the responsibility of "*geotechnical engineer of record*" and, as such, shall perform additional tests and investigation as necessary to satisfy themselves as to the site conditions and the recommendations for site development.

Auxiliary Structures Foundation Preparation: Auxiliary structures such as free standing or retaining walls should have the existing soil beneath the structure foundation prepared in the manner recommended for the building pad except the preparation needed only to extend 18 inches below and beyond the footing.

4.2 Foundations and Settlements

Structural concrete mat foundations are suitable to support the blowers, pumps and heavy equipment. Footings shall be founded on a layer of properly prepared and compacted soil as described in Section 4.1. The foundations may be designed using an allowable soil bearing pressure of 1,500 psf for compacted native clay soil and 2,000 psf when foundations are supported on imported sands (extending a minimum of 1.0 feet below footings). The allowable soil pressure may be increased by 20% for each foot of embedment depth in excess of 18 inches and by one-third for short term loads induced by winds or seismic events. The maximum allowable soil pressure at increased embedment depths shall not exceed 3,000 psf.

Flat Plate Structural Mats: Structural mats may be designed for a modulus of subgrade reaction (Ks) of 100 pci when placed on compacted native soil or a subgrade modulus of 250 pci when placed on 2.5 feet of granular fill. Mats shall overlay 2 inches of sand and a 10-mil polyethylene vapor retarder. The building support pad shall be moisture conditioned and recompacted as specified in Section 4.1 of this report.

All footings should be embedded a minimum of 18 inches below the building support pad or lowest adjacent final grade, whichever is deeper. Continuous wall footings should have a minimum width of 12 inches. Spread footings should have a minimum width of 24 inches. Recommended concrete reinforcement and sizing for all footings should be provided by the structural engineer.

Resistance to horizontal loads will be developed by passive earth pressure on the sides of footings and frictional resistance developed along the bases of footings and concrete slabs. Passive resistance to lateral earth pressure may be calculated using an equivalent fluid pressure of 250 pcf (300 pcf for import sands) to resist lateral loadings. The top one foot of embedment should not be considered in computing passive resistance unless the adjacent area is confined by a slab or pavement. An allowable friction coefficient of 0.25 (0.35 for import sands) may also be used at the base of the footings to resist lateral loading.

Foundation movement under the estimated static (non-seismic) loadings and static site conditions are estimated to not exceed ¾ inch with differential movement of about two-thirds of total movement for the loading assumptions stated above when the subgrade preparation guidelines given above are followed. Seismically induced liquefaction settlement may be on the order of ½ inch.

4.3 Slabs-On-Grade

Concrete slabs and flatwork placed over native clay soil should either be uniformly thick structural mats (9 inches or greater) or should be designed in accordance with Chapter 18, Division III of the 2001 CBC and shall be a minimum of 5 inches thick due to expansive soil conditions. Concrete floor slabs shall be monolithically placed with the foundations unless placed on 2.5 feet of granular fill soil. The concrete slabs should be underlain by a 10-mil polyethylene vapor retarder that works as a capillary break to inhibit moisture migration into the slab section. The vapor retarder should be properly lapped and sealed and extend a minimum of 12 inches into the footings. The vapor retarder should be placed between two 2 inch layers of clean sand (Sand Equivalent SE>30) unless placed on 2.5 feet of granular fill which will allow the vapor retarder to lie directly on the granular fill with 2 inches of clean sand cover. Concrete slabs may be placed directly over a 15-mil vapor retarder if desired (Stego-Wrap or equivalent).

Concrete slab and flatwork reinforcement should consist of chaired rebar slab reinforcement (minimum of No. 3 bars at 18-inch centers, both horizontal directions) placed at slab mid-height to resist potential swell forces and cracking. Slab thickness and steel reinforcement are minimums only and should be verified by the structural engineer/designer knowing the actual project loadings. All steel components of the foundation system should be protected from corrosion by maintaining a 3-inch minimum concrete cover of densely consolidated concrete at footings (by use of a vibrator).

The construction joint between the foundation and any mowstrips/sidewalks placed adjacent to foundations should be sealed with a polyurethane based non-hardening sealant to prevent moisture migration between the joint. Epoxy coated embedded steel components or permanent waterproofing membranes placed at the exterior footing sidewall may also be used to mitigate the corrosion potential of concrete placed in contact with native soil.

Control joints should be provided in all concrete slabs-on-grade at a maximum spacing (in feet) of 2 to 3 times the slab thickness (in inches) as recommended by American Concrete Institute (ACI) guidelines. All joints should form approximately square patterns to reduce randomly oriented contraction cracks. Contraction joints in the slabs should be tooled at the time of the pour or sawcut (¼ of slab depth) within 6 to 8 hours of concrete placement. Construction (cold) joints in foundations and area flatwork should either be thickened butt-joints with dowels or a thickened keyed-joint designed to resist vertical deflection at the joint. All joints in flatwork should be sealed to prevent moisture, vermin, or foreign material intrusion. Precautions should be taken to prevent curling of slabs in this arid desert region (refer to ACI guidelines).

All independent flatwork (sidewalks, housekeeping slabs) should be placed on a minimum of 2 inches of concrete sand or aggregate base, dowelled to the perimeter foundations where adjacent to buildings and sloped 2% away from the building. A minimum of 24 inches of moisture conditioned (5% minimum above optimum) and 8 inches of compacted subgrade (83 to 87%) and a 10-mil (minimum) polyethylene separation sheet should underlie the flatwork containing steel reinforcing (unless reinforced with wire mesh). All flatwork should be jointed in square patterns and at irregularities in shape at a maximum spacing of 10 feet or the least width of the sidewalk.

4.4 Sewer Lift Station Geotechnical Design Criteria

The lift station may be designed for an allowable soil bearing pressure of 3,000 pounds per square foot (psf) at the base of the station. Footings and equipment foundations which are embedded a minimum of 18 inches into native soil or compacted backfill around the pump wet-well may be designed for an allowable bearing pressure of 1,500 psf. It is suggested that rigid mat be used for structures placed over wet well backfill. Horizontal sliding can be resisted with passive earth pressure equivalent to 250 pounds per cubic foot (pcf) of fluid pressure and a coefficient of friction of 0.25. Groundwater buoyant forces and lateral loads should be considered for wet well depth greater than 10 feet below ground surface. Active earth pressures of 55 pcf should be used above groundwater and at-rest pressures of 70 pcf should be used for braced walls. Dewatering of the wet well site prior to excavation will be required.

4.5 Excavations

All site excavations should conform to CalOSHA requirements for Type B soil. The contractor is solely responsible for the safety of workers entering trenches. Temporary excavations with depths of 4 feet or less may be cut nearly vertical for short duration. Excavations deeper than 4 feet will require shoring or slope inclinations in conformance to CAL/OSHA regulations for Type B soil. These temporary deep excavations will require slope inclinations no steeper than 1½(H):1(V) unless trench shoring is used. If excavations are planned below groundwater (10 feet below ground surface), all excavation slopes should be excavated according to OSHA Standards for Type C soils. Dewatering of the excavation site will be required prior to start of excavation.

All unlined permanent slopes (sludge drying bed) should not be steeper than 3:1 to reduce wind and rain erosion. Protected slopes with ground cover may be as steep as 2:1. However, maintenance with motorized equipment may not be possible at this inclination. Biolac lagoon and sludge drying bed embankment construction shall be properly prepared and compacted as described in Section 4.1.

All discussions in this section regarding stable excavation slopes assumes minimal equipment vibration and adequate setback of excavated material and construction equipment from the top of the excavation. We recommended that the minimum setback distance be equal to the depth of excavation and at least 10 feet from the crown of the slope. If excavated materials are stockpiled adjacent to the excavation, the weight of the material should be considered as a surcharge load for slope stability.

Excavation for the sewer lift station will encounter the groundwater table (10 feet depth). Therefore, seepage and pumping subgrade conditions should be anticipated. An adequately designed dewatering system, such as well points or sumps, will be required to control groundwater seepage and prevent running ground conditions. The bottom of lift station should be underlain by a minimum of 18 inches of 1-inch crushed rock (ASTM C33, size 57) wrapped in a geotextile filter cloth.

The responsibility for dewatering and selection of an appropriate system for dewatering is beyond the scope of this report.

4.6 Concrete Mixes and Corrosivity

Selected chemical analyses for corrosivity were conducted on bulk samples of the near surface soil from the project site (Plate C-2). The native soils were found to have moderate to severe levels of sulfate ion concentration (1,942 to 2,844 ppm). Sulfate ions in high concentrations can attack the cementitious material in concrete, causing weakening of the cement matrix and eventual deterioration by raveling. The California Building Code recommends that increased quantities of Type II Portland Cement be used at a low water/cement ratio when concrete is subjected to moderate sulfate concentrations. Type V Portland Cement and/or Type II/V cement with 25% flyash replacement is recommended when the concrete is subjected to soil with severe sulfate concentration.

A minimum of 6.25 sacks per cubic yard of concrete (4,500 psi) of Type V Portland Cement with a maximum water/cement ratio of 0.45 (by weight) should be used for concrete placed in contact with native soil on this project (sitework including sidewalks, housekeeping slabs, and foundations). Admixtures may be required to allow placement of this low water/cement ratio concrete.

The native soil has severe to very severe levels of chloride ion concentration (1,000 to 16,480 ppm). Chloride ions can cause corrosion of reinforcing steel, anchor bolts and other buried metallic conduits. Resistivity determinations on the soil indicate very severe potential for metal loss because of electrochemical corrosion processes. Mitigation of the corrosion of steel can be achieved by using steel pipes coated with epoxy corrosion inhibitors, asphaltic and epoxy coatings, cathodic protection or by encapsulating the portion of the pipe lying above groundwater with a minimum of 4 inches of densely consolidated concrete. ***No metallic pipes or conduits should be placed below foundations.***

Foundation designs shall provide a minimum concrete cover of four (4) inches around steel reinforcing or embedded components (anchor bolts, etc.) exposed to native soil or landscape water (to 18 inches above grade). If the 4-inch concrete edge distance cannot be achieved, all embedded steel components (anchor bolts, etc.) shall be epoxy dipped for corrosion protection or a corrosion inhibitor and a permanent waterproofing membrane shall be placed along the exterior face of the exterior footings. ***Hold-down straps should not be used at foundation edges due to corrosion of metal at its protrusion from the slab edge.*** Additionally, the concrete should be thoroughly vibrated at footings during placement to decrease the permeability of the concrete. ***Copper water piping should not be placed under floor slabs.***

4.7 Seismic Design

This site is located in the seismically active southern California area and the site structures are subject to strong ground shaking due to potential fault movements along the Brawley, Superstition Hills, and Imperial Faults. Engineered design and earthquake-resistant construction are the common solutions to increase safety and development of seismic areas. Designs should comply with the latest edition of the CBC for Seismic Zone 4 using the seismic coefficients given in Section 3.4 of this report. ***This site lies about 3.5 km from a Type A fault and overlies S_D (stiff) soil.***

Section 5
LIMITATIONS AND ADDITIONAL SERVICES

5.1 Limitations

The recommendations and conclusions within this report are based on current information regarding the proposed improvements to the existing Imperial WWTP located at the northeast corner of 15th Street and North N Street in northeast Imperial, California. The conclusions and recommendations of this report are invalid if:

- Structural loads change from those stated or the structures are relocated.
- The Additional Services section of this report is not followed.
- This report is used for adjacent or other property.
- Changes of grade or groundwater occur between the issuance of this report and construction other than those anticipated in this report.
- Any other change that materially alters the project from that proposed at the time this report was prepared.

Findings and recommendations in this report are based on selected points of field exploration, geologic literature, laboratory testing, and our understanding of the proposed project. Our analysis of data and recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific exploratory locations. Variations in soil conditions can exist between and beyond the exploration points or groundwater elevations may change. If detected, these conditions may require additional studies, consultation, and possible design revisions.

This report contains information that may be useful in the preparation of contract specifications. However, the report is not worded is such a manner that we recommend its use as a construction specification document without proper modification. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

This report was prepared according to the generally accepted *geotechnical engineering standards of practice* that existed in Imperial County at the time the report was prepared. No express or implied warranties are made in connection with our services.

This report should be considered invalid for periods after two years from the report date without a review of the validity of the findings and recommendations by our firm, because of potential changes in the Geotechnical Engineering Standards of Practice.

The client has responsibility to see that all parties to the project including, designer, contractor, and subcontractor are made aware of this entire report. The use of information contained in this report for bidding purposes should be done at the contractor's option and risk.

5.2 Additional Services

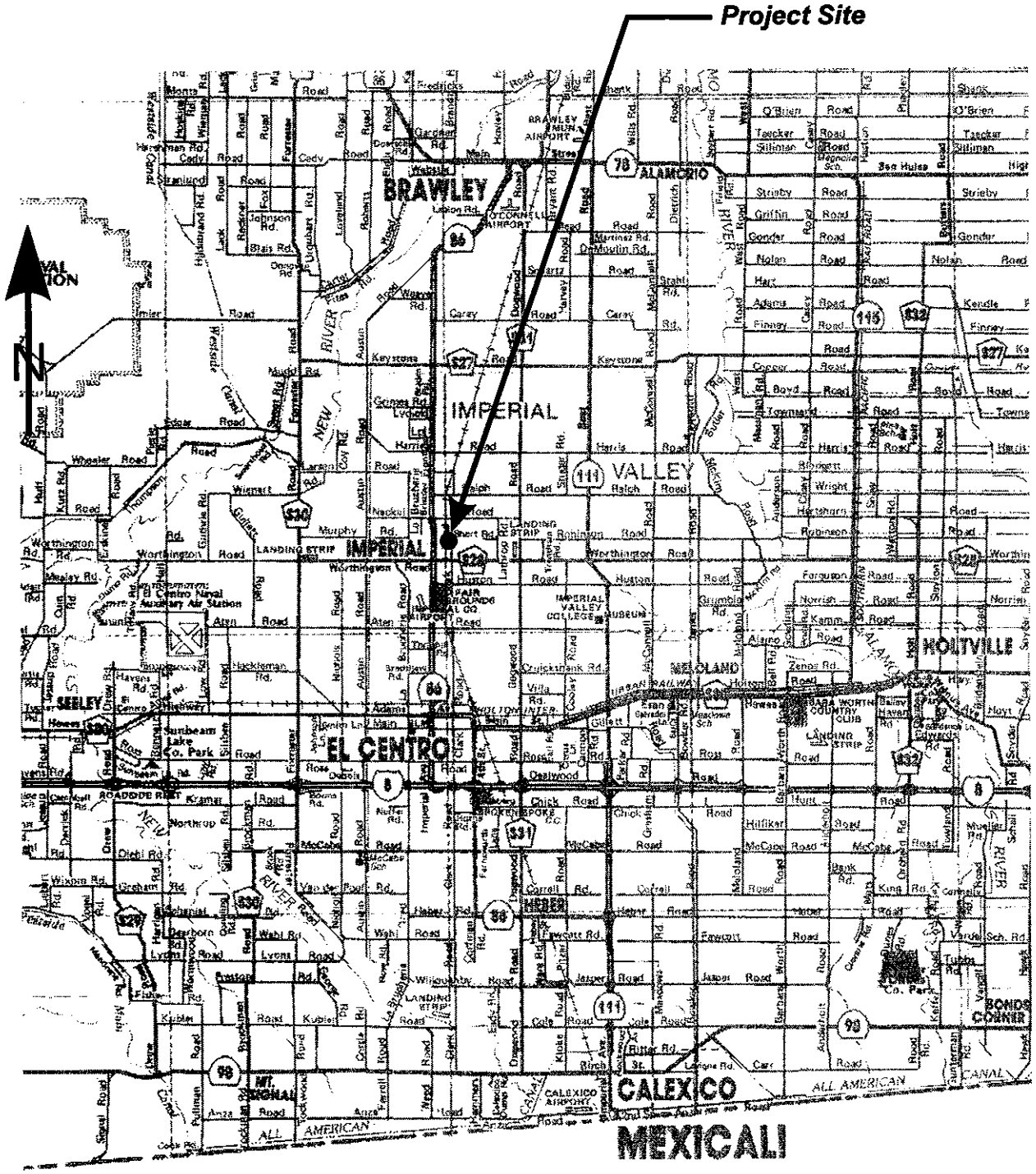
We recommend that Landmark Consultants, Inc. be retained as the geotechnical consultant to provide the tests and observations services during construction. If Landmark Consultants does not provide such services then *the geotechnical engineering firm providing such tests and observations shall become the geotechnical engineer of record and assume responsibility for the project.*

The recommendations presented in this report are based on the assumption that:

- Consultation during development of design and construction documents to check that the geotechnical recommendations are appropriate for the proposed project and that the geotechnical recommendations are properly interpreted and incorporated into the documents.
- Landmark Consultants will have the opportunity to review and comment on the plans and specifications for the project prior to the issuance of such for bidding.
- Continuous observation, inspection, and testing by the geotechnical consultant of record during site clearing, grading, excavation, placement of fills, building pad and subgrade preparation, and backfilling of utility trenches.
- Observation of foundation excavations and reinforcing steel before concrete placement.
- Other consultation as necessary during design and construction.

We emphasize our review of the project plans and specifications to check for compatibility with our recommendations and conclusions. Additional information concerning the scope and cost of these services can be obtained from our office.

APPENDIX A



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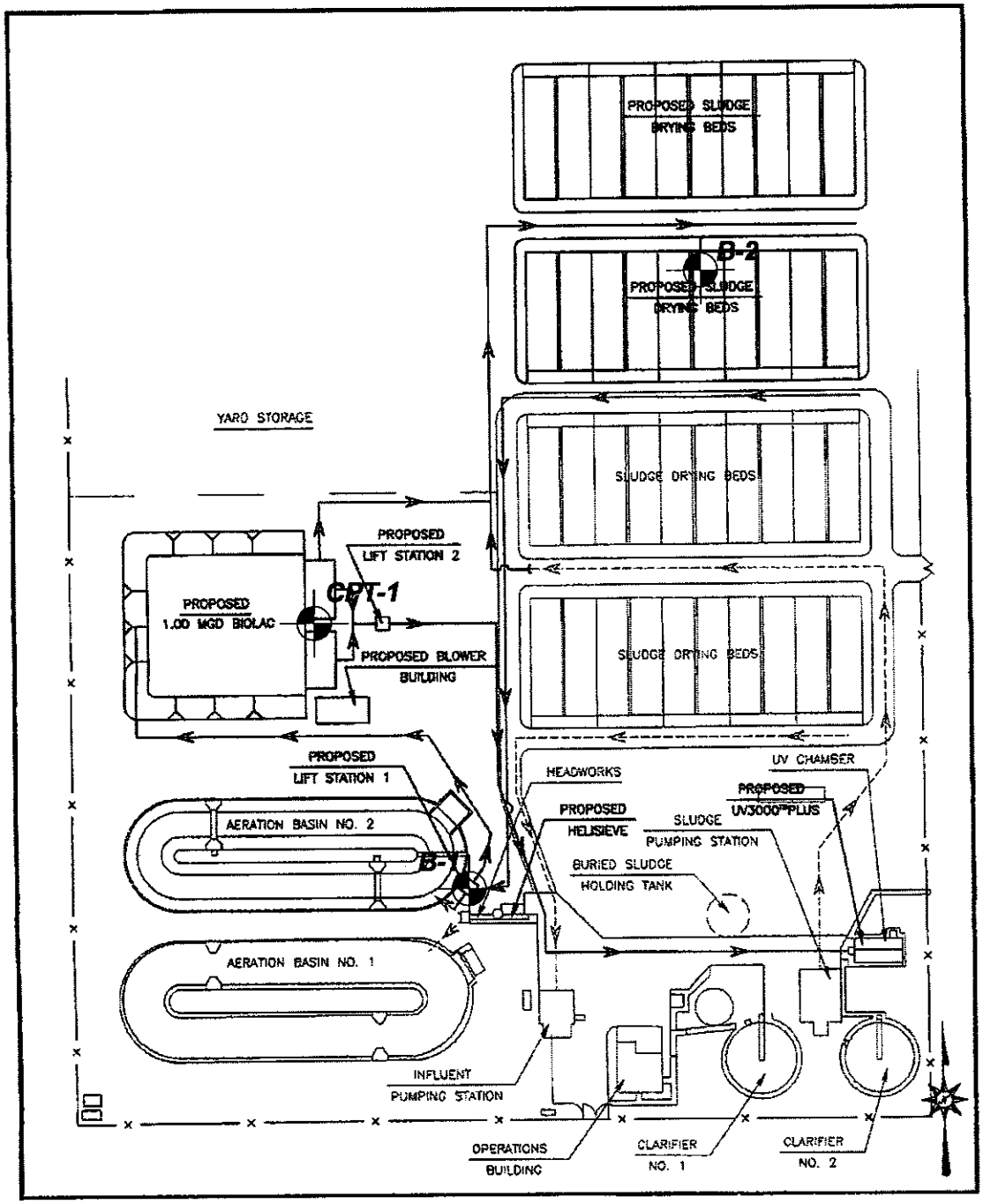
Project No.: LE06111

Vicinity Map

Plate A-1



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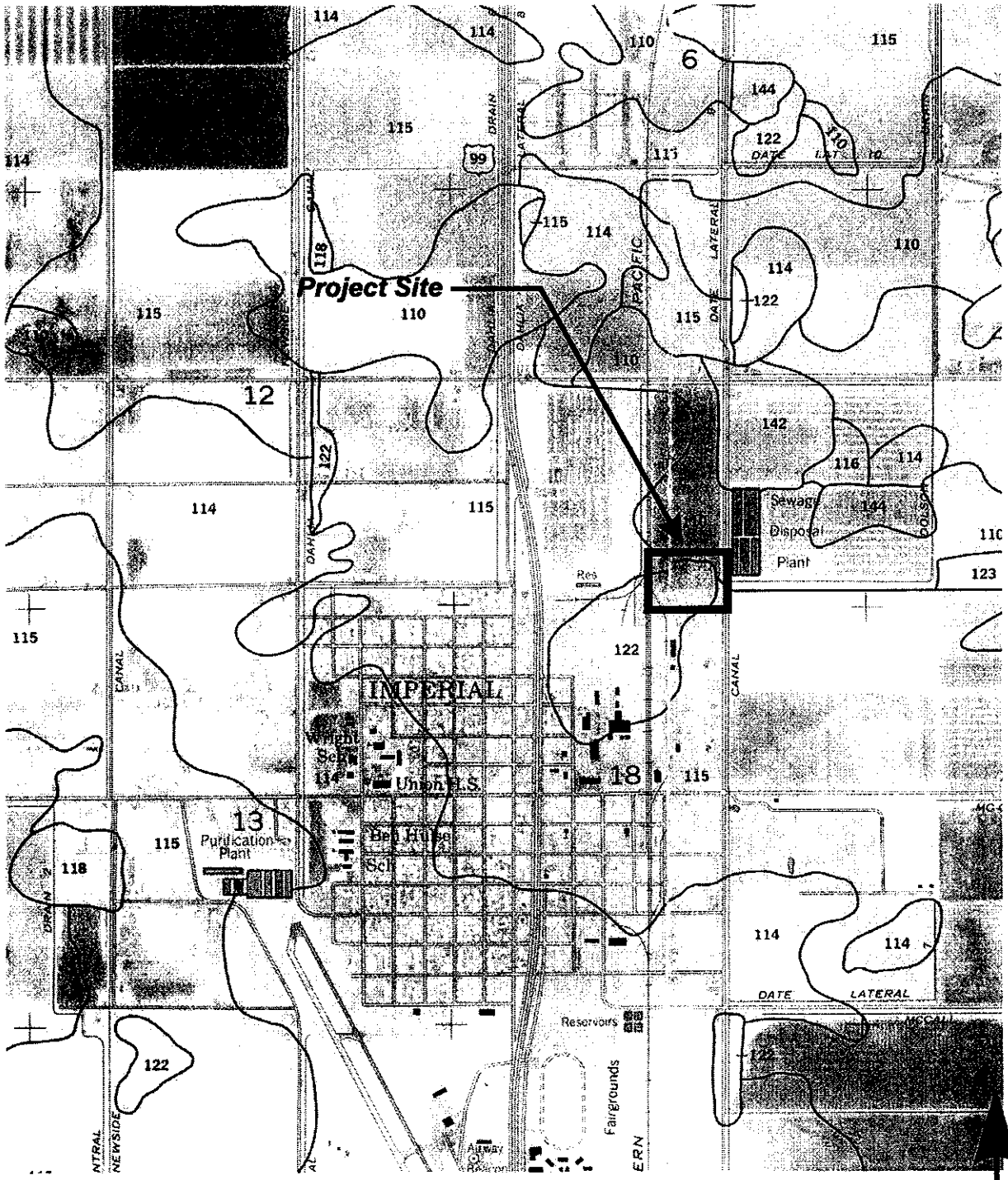
Project No.: LE06111

Site and Exploration Map

Plate A-2



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Project No.: LE06111

Soil Survey Map

Plate A-3

Soil Survey of

IMPERIAL COUNTY CALIFORNIA IMPERIAL VALLEY AREA

United States Department of Agriculture Soil Conservation Service
in cooperation with
University of California Agricultural Experiment Station
and
Imperial Irrigation District

TABLE 11.--ENGINEERING INDEX PROPERTIES

[The symbol > means more than. Absence of an entry indicates that data were not estimated]

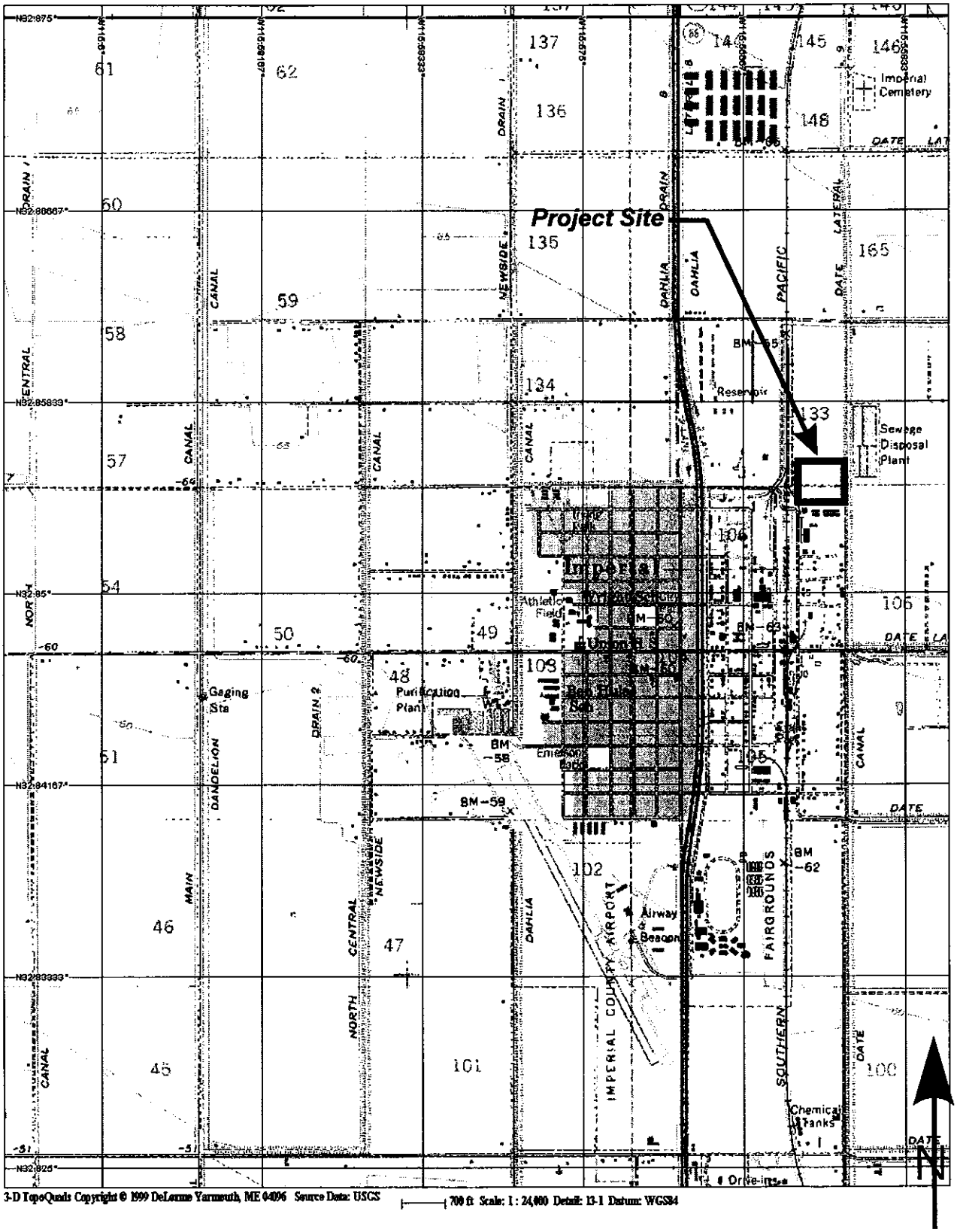
Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
100---------- Antho	0-13	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	13-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
101*:											
Antho----------	0-8	Loamy fine sand	SM	A-2	0	100	100	75-85	10-30	---	NP
	8-60	Sandy loam, fine sandy loam.	SM	A-2, A-4	0	90-100	75-95	50-60	15-40	---	NP
Superstition------	0-6	Fine sand-------	SM	A-2	0	100	95-100	70-85	15-25	---	NP
	6-60	Loamy fine sand, fine sand, sand.	SM	A-2	0	100	95-100	70-85	15-25	---	NP
102*. Badland											
103---------- Carsitas	0-10	Gravelly sand---	SP, SP-SM	A-1, A-2	0-5	60-90	50-85	30-55	0-10	---	NP
	10-60	Gravelly sand, gravelly coarse sand, sand.	SP, SP-SM	A-1	0-5	60-90	50-85	25-50	0-10	---	NP
104* Fluvaquents											
105---------- Glenbar	0-13	Clay loam-------	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
	13-60	Clay loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-95	35-45	15-30
106---------- Glenbar	0-13	Clay loam-------	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	35-45	15-25
107*---------- Glenbar	0-13	Loam----------	ML, CL-ML, CL	A-4	0	100	100	100	70-80	20-30	NP-10
	13-60	Clay loam, silty clay loam.	CL	A-6, A-7	0	100	100	95-100	75-95	35-45	15-30
108---------- Holtville	0-14	Loam----------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	14-22	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	22-60	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
109---------- Holtville	0-17	Silty clay------	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	65-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
110---------- Holtville	0-17	Silty clay------	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	17-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-35	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	35-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP

See footnote at end of table.

TABLE 11.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
121---------- Meloland	0-12	Fine sand-------	SM, SP-SM	A-2, A-3	0	95-100	90-100	75-100	5-30	---	NP
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-65	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	100	95-100	85-95	40-65	20-40
122---------- Meloland	0-12	Very fine sandy loam.	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-71	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
123*: Meloland----------	0-12	Loam----------	ML	A-4	0	95-100	95-100	95-100	55-85	25-35	NP-10
	12-26	Stratified loamy fine sand to silt loam.	ML	A-4	0	100	100	90-100	50-70	25-35	NP-10
	26-38	Clay, silty clay, silty clay loam.	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-40
	38-60	Stratified silt loam to loamy fine sand.	SM, ML	A-4	0	100	100	75-100	35-55	25-35	NP-10
Holtville---------	0-12	Loam----------	ML	A-4	0	100	100	85-100	55-95	25-35	NP-10
	12-24	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-95	40-65	20-35
	24-36	Silt loam, very fine sandy loam.	ML	A-4	0	100	100	95-100	55-85	25-35	NP-10
	36-60	Loamy very fine sand, loamy fine sand.	SM, ML	A-2, A-4	0	100	100	75-100	20-55	---	NP
124, 125---------- Niland	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
126---------- Niland	0-23	Fine sand-------	SM, SP-SM	A-2, A-3	0	90-100	90-100	50-65	5-25	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
127---------- Niland	0-23	Loamy fine sand	SM	A-2	0	90-100	90-100	50-65	15-30	---	NP
	23-60	Silty clay------	CL, CH	A-7	0	100	100	85-100	80-95	40-65	20-40
128*: Niland----------	0-23	Gravelly sand---	SM, SP-SM	A-2, A-3	0	90-100	70-95	50-65	5-25	---	NP
	23-60	Silty clay, clay, clay loam.	CL, CH	A-7	0	100	100	85-100	80-100	40-65	20-40
Imperial----------	0-12	Silty clay------	CH	A-7	0	100	100	100	85-95	50-70	25-45
	12-60	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	100	85-95	50-70	25-45
129*: Pits											
130, 131---------- Rositas	0-27	Sand----------	SP-SM	A-3, A-1, A-2	0	100	80-100	40-70	5-15	---	NP
	27-60	Sand, fine sand, loamy sand.	SM, SP-SM	A-3, A-2, A-1	0	100	80-100	40-85	5-30	---	NP

See footnote at end of table.



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Project No.: LE06111

Topographic Map

Plate A-4

APPENDIX B

CLIENT: The Holt Group

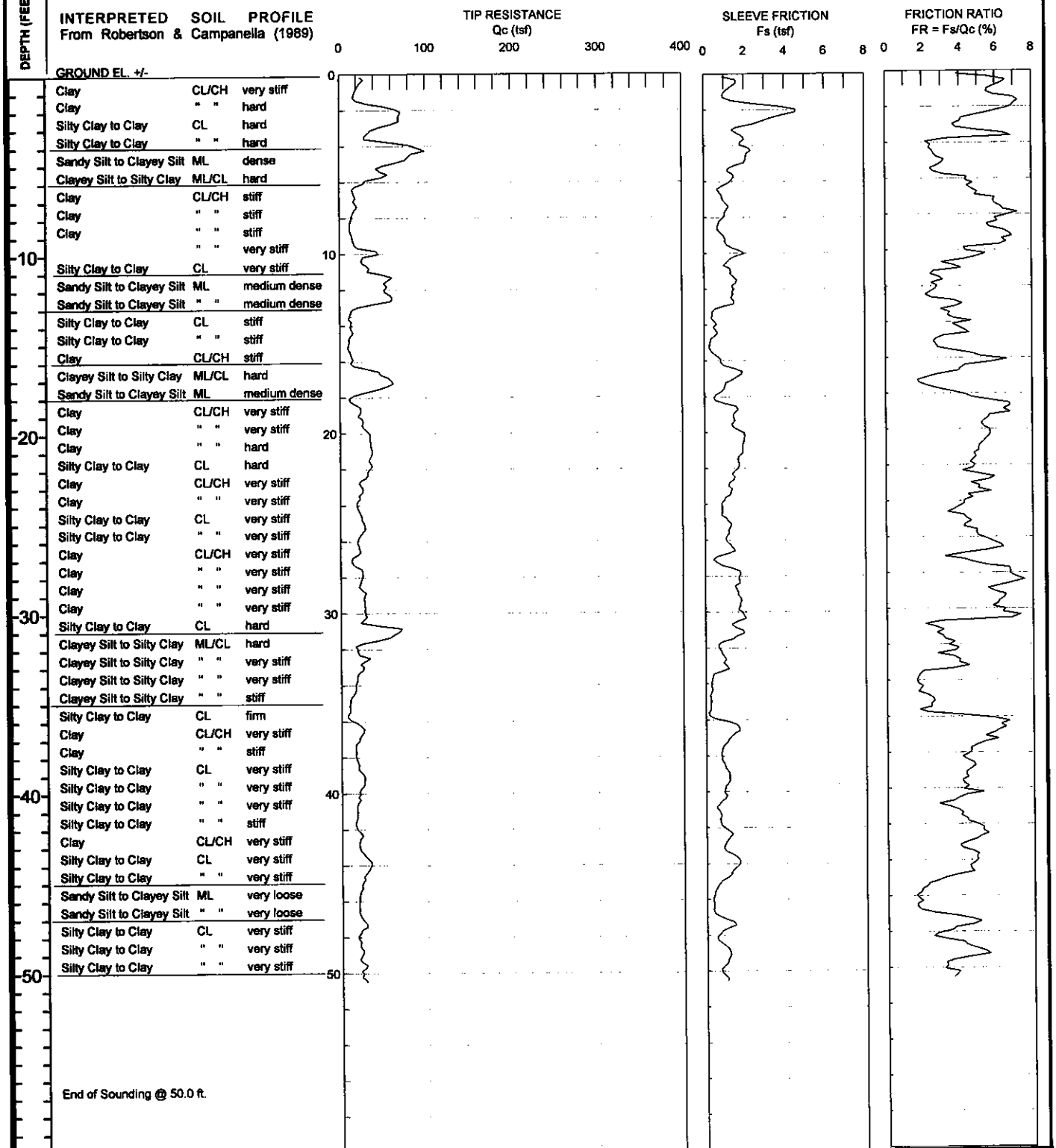
PROJECT: Imperial WWTP Upgrades, Imperial, CA

LOCATION: See Site and Boring Location Plan

CONE PENETROMETER: HOLGUIN, FAHAN & ASSC. Truck Mounted Electric Cone with 23 ton reaction weight

DATE: 04/04/06

LOG OF CONE SOUNDING DATA CPT-1



Project No: LE06111

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Plate B-1

LANDMARK CONSULTANTS, INC.

CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Imperial WWTP Upgrades, Imperial, CA Project No: LE06111 Date: 04/04/06

CONE SOUNDING: CPT-1

Est. GWT (ft): 10.0 Phi Correlation: 0 (0-Schm(78),1-R&C(83),2-PHT(74))

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	1 Soil Type	Soil Classification	USC	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Cn or Cq	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	Nk: Phi (deg.)	17.0 Su (tsf)	OCR
0.15	0.5	25.89	5.33	3 Clay	CL/CH	very stiff	125	1.3	21	2.00		80				1.52	>10
0.30	1.0	20.40	5.97	3 Clay	CL/CH	very stiff	125	1.3	16	2.00		90				1.20	>10
0.45	1.5	17.76	6.14	3 Clay	CL/CH	very stiff	125	1.3	14	2.00		95				1.04	>10
0.60	2.0	50.91	7.07	3 Clay	CL/CH	hard	125	1.3	41	2.00		70				2.99	>10
0.75	2.5	70.15	5.58	11 Overconsolidated Soil	??	very dense	120	1.0	70	2.00	132.6	55	90	41			
0.93	3.0	58.45	3.95	5 Clayey Silt to Silty Clay	ML/CL	hard	120	2.5	23	2.00		50				3.43	>10
1.08	3.5	33.32	5.03	3 Clay	CL/CH	very stiff	125	1.3	27	2.00		70				1.95	>10
1.23	4.0	55.40	4.11	5 Clayey Silt to Silty Clay	ML/CL	hard	120	2.5	22	2.00		50				3.25	>10
1.38	4.5	91.41	2.45	7 Silty Sand to Sandy Silt	SM/ML	dense	115	4.5	20	2.00	172.8	30	89	40			
1.53	5.0	73.70	2.83	6 Sandy Silt to Clayey Silt	ML	dense	115	3.5	21	1.91	133.2	40	81	39			
1.68	5.5	49.59	2.72	6 Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	14	1.82	85.5	45	68	37			
1.83	6.0	35.56	3.97	5 Clayey Silt to Silty Clay	ML/CL	hard	120	2.5	14	1.74		60				2.07	>10
1.98	6.5	16.59	4.62	3 Clay	CL/CH	stiff	125	1.3	13	1.67		90				0.95	>10
2.13	7.0	17.42	5.28	3 Clay	CL/CH	very stiff	125	1.3	14	1.61		90				1.00	>10
2.28	7.5	19.18	6.05	3 Clay	CL/CH	very stiff	125	1.3	15	1.58		95				1.10	>10
2.45	8.0	14.85	6.75	3 Clay	CL/CH	stiff	125	1.3	12	1.55		100				0.85	>10
2.60	8.5	12.11	5.89	3 Clay	CL/CH	stiff	125	1.3	10	1.52		100				0.69	>10
2.75	9.0	13.36	6.28	3 Clay	CL/CH	stiff	125	1.3	11	1.50		100				0.76	>10
2.90	9.5	16.25	6.64	3 Clay	CL/CH	stiff	125	1.3	13	1.47		100				0.93	>10
3.05	10.0	36.71	4.95	3 Clay	CL/CH	hard	125	1.3	29	1.45		70				2.13	>10
3.20	10.5	26.63	4.89	3 Clay	CL/CH	very stiff	125	1.3	21	1.43		75				1.54	>10
3.35	11.0	33.04	3.60	5 Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	13	1.41		65				1.91	>10
3.50	11.5	55.90	2.64	6 Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	16	1.39	73.4	45	63	37			
3.65	12.0	53.04	2.78	6 Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	15	1.37	68.8	45	61	37			
3.80	12.5	57.71	2.42	6 Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	16	1.36	74.0	40	64	37			
3.95	13.0	40.66	3.44	5 Clayey Silt to Silty Clay	ML/CL	hard	120	2.5	16	1.34		60				2.36	>10
4.13	13.5	12.77	3.41	4 Silty Clay to Clay	CL	stiff	125	1.8	7	1.32		100				0.72	>10
4.28	14.0	12.39	3.90	3 Clay	CL/CH	stiff	125	1.3	10	1.31		100				0.69	7.41
4.43	14.5	14.14	3.94	4 Silty Clay to Clay	CL	stiff	125	1.8	8	1.29		100				0.79	>10
4.58	15.0	11.23	3.46	4 Silty Clay to Clay	CL	stiff	125	1.8	6	1.28		100				0.62	7.56
4.73	15.5	10.31	2.71	4 Silty Clay to Clay	CL	stiff	125	1.8	6	1.26		100				0.57	6.32
4.88	16.0	13.61	5.02	3 Clay	CL/CH	stiff	125	1.3	11	1.25		100				0.76	7.41
5.03	16.5	31.73	4.74	4 Silty Clay to Clay	CL	very stiff	125	1.8	18	1.23		80				1.83	>10
5.18	17.0	54.69	3.03	6 Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	16	1.22	63.0	55	59	36			
5.33	17.5	53.55	1.94	7 Silty Sand to Sandy Silt	SM/ML	medium dense	115	4.5	12	1.21	61.2	45	58	36			
5.48	18.0	18.75	3.60	4 Silty Clay to Clay	CL	very stiff	125	1.8	11	1.20		95				1.06	>10
5.65	18.5	17.48	5.73	3 Clay	CL/CH	stiff	125	1.3	14	1.18		100				0.98	9.79
5.80	19.0	23.17	6.65	3 Clay	CL/CH	very stiff	125	1.3	19	1.17		100				1.32	>10
5.95	19.5	26.31	5.50	3 Clay	CL/CH	very stiff	125	1.3	21	1.16		95				1.50	>10
6.10	20.0	31.21	5.40	3 Clay	CL/CH	very stiff	125	1.3	25	1.15		90				1.79	>10
6.25	20.5	35.42	5.58	3 Clay	CL/CH	hard	125	1.3	28	1.14		90				2.04	>10
6.40	21.0	36.69	5.16	3 Clay	CL/CH	hard	125	1.3	29	1.13		85				2.11	>10
6.55	21.5	35.52	4.91	4 Silty Clay to Clay	CL	hard	125	1.8	20	1.12		85				2.04	>10
6.70	22.0	35.98	4.71	4 Silty Clay to Clay	CL	hard	125	1.8	21	1.11		85				2.07	>10
6.85	22.5	31.58	4.64	4 Silty Clay to Clay	CL	very stiff	125	1.8	18	1.10		90				1.81	>10
7.00	23.0	23.93	5.36	3 Clay	CL/CH	very stiff	125	1.3	19	1.09		100				1.36	>10
7.18	23.5	24.96	5.27	3 Clay	CL/CH	very stiff	125	1.3	20	1.08		100				1.41	>10
7.33	24.0	20.98	4.47	3 Clay	CL/CH	very stiff	125	1.3	17	1.07		100				1.18	9.39
7.48	24.5	21.73	3.97	4 Silty Clay to Clay	CL	very stiff	125	1.8	12	1.06		100				1.22	>10
7.63	25.0	25.76	3.97	4 Silty Clay to Clay	CL	very stiff	125	1.8	15	1.05		95				1.46	>10
7.78	25.5	28.44	4.38	4 Silty Clay to Clay	CL	very stiff	125	1.8	16	1.04		95				1.62	>10
7.93	26.0	22.49	4.94	3 Clay	CL/CH	very stiff	125	1.3	18	1.03		100				1.26	9.39
8.08	26.5	21.92	5.98	3 Clay	CL/CH	very stiff	125	1.3	18	1.03		100				1.23	8.70
8.23	27.0	16.04	4.28	3 Clay	CL/CH	stiff	125	1.3	13	1.02		100				0.88	5.00
8.38	27.5	18.95	4.79	3 Clay	CL/CH	very stiff	125	1.3	15	1.01		100				1.05	6.32
8.53	28.0	25.54	6.74	3 Clay	CL/CH	very stiff	125	1.3	20	1.00		100				1.44	>10
8.68	28.5	22.76	7.18	3 Clay	CL/CH	very stiff	125	1.3	18	1.00		100				1.28	8.27
8.85	29.0	27.52	5.86	3 Clay	CL/CH	very stiff	125	1.3	22	0.99		100				1.56	>10
9.00	29.5	27.69	6.37	3 Clay	CL/CH	very stiff	125	1.3	22	0.98		100				1.56	>10
9.15	30.0	28.53	6.11	3 Clay	CL/CH	very stiff	125	1.3	23	0.97		100				1.61	>10

LANDMARK CONSULTANTS, INC.

CONE PENETROMETER INTERPRETATION (based on Robertson & Campanella, 1989, refer to Key to CPT logs)

Project: Imperial WWTP Upgrades, Imperial, CA Project No: LE06111 Date: 04/04/06

CONE SOUNDING: CPT-1

Est. GWT (ft): 10.0 Phi Correlation: 0 0-Schm(78),1-R&C(83),2-PHT(74)

Base Depth meters	Base Depth feet	Avg Tip Qc, tsf	Avg Friction Ratio, %	1 Soil Type	Soil Classification	USC	Density or Consistency	Est. Density (pcf)	Qc to N	SPT N(60)	Cn or Cq	Norm. Qc1n	Est. % Fines	Rel. Dens. Dr (%)	Nk: Phi (deg.)	17.0 Su (tsf)	OCR
9.30	30.5	27.15	6.83	3	Clay	CL/CH	very stiff	125	1.3	22	0.97		100			1.53	>10
9.45	31.0	61.32	2.59	6	Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	18	0.96	55.7	60	55	36		
9.60	31.5	55.40	2.94	6	Sandy Silt to Clayey Silt	ML	medium dense	115	3.5	16	0.96	50.1	65	52	35		
9.75	32.0	21.04	3.39	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	8	0.95		100			1.17	>10
9.90	32.5	25.49	3.46	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	10	0.94		100			1.43	>10
10.05	33.0	25.90	3.84	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	10	0.94		100			1.45	>10
10.20	33.5	22.09	3.36	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	9	0.93		100			1.23	>10
10.38	34.0	18.45	1.73	6	Sandy Silt to Clayey Silt	ML	very loose	115	3.5	5	0.93	16.2	95	19	31		
10.53	34.5	16.81	1.82	6	Sandy Silt to Clayey Silt	ML	very loose	115	3.5	5	0.92	14.7	100	16	30		
10.68	35.0	11.46	2.14	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	2.5	5	0.92		100			0.60	3.58
10.83	35.5	10.26	2.45	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	2.5	4	0.91		100			0.53	3.07
10.98	36.0	8.94	2.75	4	Silty Clay to Clay	CL	firm	125	1.8	5	0.91		100			0.45	1.84
11.13	36.5	23.68	6.30	3	Clay	CL/CH	very stiff	125	1.3	19	0.90		100			1.32	6.32
11.28	37.0	22.16	5.75	3	Clay	CL/CH	very stiff	125	1.3	18	0.90		100			1.23	5.53
11.43	37.5	17.05	5.42	3	Clay	CL/CH	stiff	125	1.3	14	0.89		100			0.92	3.66
11.58	38.0	17.20	4.52	3	Clay	CL/CH	stiff	125	1.3	14	0.89		100			0.93	3.58
11.73	38.5	19.98	4.35	4	Silty Clay to Clay	CL	very stiff	125	1.8	11	0.88		100			1.10	5.76
11.88	39.0	24.20	4.55	4	Silty Clay to Clay	CL	very stiff	125	1.8	14	0.88		100			1.34	7.85
12.05	39.5	26.73	4.25	4	Silty Clay to Clay	CL	very stiff	125	1.8	15	0.87		100			1.49	9.19
12.20	40.0	22.00	4.23	4	Silty Clay to Clay	CL	very stiff	125	1.8	13	0.87		100			1.21	6.32
12.35	40.5	20.46	4.47	3	Clay	CL/CH	very stiff	125	1.3	16	0.86		100			1.12	4.28
12.50	41.0	18.07	3.25	5	Clayey Silt to Silty Clay	ML/CL	stiff	120	2.5	7	0.86		100			0.98	6.10
12.65	41.5	17.82	3.97	4	Silty Clay to Clay	CL	stiff	125	1.8	10	0.85		100			0.96	4.28
12.80	42.0	17.10	4.54	3	Clay	CL/CH	stiff	125	1.3	14	0.85		100			0.92	3.21
12.95	42.5	22.74	5.30	3	Clay	CL/CH	very stiff	125	1.3	18	0.84		100			1.25	4.78
13.10	43.0	20.61	4.75	3	Clay	CL/CH	very stiff	125	1.3	16	0.84		100			1.12	4.00
13.25	43.5	24.67	4.19	4	Silty Clay to Clay	CL	very stiff	125	1.8	14	0.83		100			1.36	6.76
13.40	44.0	33.03	4.88	3	Clay	CL/CH	very stiff	125	1.3	26	0.83		100			1.85	8.41
13.58	44.5	30.46	4.56	4	Silty Clay to Clay	CL	very stiff	125	1.8	17	0.83		100			1.70	9.79
13.73	45.0	25.53	3.88	4	Silty Clay to Clay	CL	very stiff	125	1.8	15	0.82		100			1.41	6.76
13.88	45.5	22.92	2.39	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	9	0.82		100			1.26	7.85
14.03	46.0	20.39	1.75	6	Sandy Silt to Clayey Silt	ML	very loose	115	3.5	6	0.81	15.7	100	18	30		
14.18	46.5	19.87	1.72	6	Sandy Silt to Clayey Silt	ML	very loose	115	3.5	6	0.81	15.2	100	17	30		
14.33	47.0	22.39	2.41	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	9	0.81		100			1.22	7.13
14.48	47.5	26.98	4.75	3	Clay	CL/CH	very stiff	125	1.3	22	0.80		100			1.49	5.42
14.63	48.0	19.92	3.26	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	8	0.80		100			1.07	5.65
14.78	48.5	21.45	3.27	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	9	0.80		100			1.16	6.32
14.93	49.0	23.72	4.75	3	Clay	CL/CH	very stiff	125	1.3	19	0.79		100			1.30	4.18
15.10	49.5	24.18	4.52	4	Silty Clay to Clay	CL	very stiff	125	1.8	14	0.79		100			1.32	5.53
15.25	50.0	24.37	3.14	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	10	0.79		100			1.33	7.56
15.40	50.5	26.43	3.71	5	Clayey Silt to Silty Clay	ML/CL	very stiff	120	2.5	11	0.78		100			1.45	8.56

CLIENT: The Holt Group
METHOD OF DRILLING: CME 55 w/autohammer
PROJECT: Imperial WWTP Upgrades, Imperial, CA
DATE OBSERVED 04/04/06
LOCATION: See Site and Exploration Plan
LOGGED BY: J.R. Avalos

LOG OF BORING B-1

SHEET 1 OF 1

DEPTH	CLASSIFICATION	SAMPLE TYPE	BLOWS/FOOT **	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	UNCONFINED COMPRESSION (TSF)	LIQUID LIMIT	PLASTICITY INDEX	PASSING #200
					SILTY CLAY (CL): Brown, moist, medium plasticity				34	19	
			6	0.75	Medium stiff to sitff consistency						
5											
			8	1.00	Very moist	25.9	101.7		31	11	
10											
			4	0.50	Soft to medium stiff consistency						
15											
			5	0.50							
20											
			15	1.50	CLAY (CH): Reddish brown, very moist, stiff to very stiff consistency and high plasticity				55	34	
25											
			5	0.50	Medium stiff consistency						
30											
35											
40					End of Boring at 29.0 ft Anticipated Groundwater 10.0 ft						

** Blows not corrected for overburden pressure, sampler size or increase drive energy for automatic hammers.

Project No: LE06111

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Plate B-2

CLIENT: The Holt Group
PROJECT: Imperial WWTP Upgrades, Imperial, CA
LOCATION: See Site and Exploration Plan

METHOD OF DRILLING: CME 55 w/autohammer
DATE OBSERVED 04/04/06
LOGGED BY: J.R. Avalos

LOG OF BORING B-2

SHEET 1 OF 1

DEPTH	CLASSIFICATION	SAMPLE TYPE	BLOWS/FOOT **	POCKET PEN. (TSF)	DESCRIPTION OF MATERIAL SURFACE ELEV. +/-	MOISTURE CONTENT (%)	DRY UNIT WT. (PCF)	UNCONFINED COMPRESSION (TSF)	LIQUID LIMIT	PLASTICITY INDEX	PASSING #200
					CLAY (CL-CH): Brown, moist, medium plasticity						
					SILT (ML): Brown, moist, with thin interbedded layer of silty clay				27	--	
5			5	0.50	SILTY CLAY (CL): Brown, very moist, medium stiff consistency and medium plasticity				40	23	95
10			4	0.75		28.0	92.7				
15			10	0.75	CLAYEY SILT (ML): Brown, saturated, medium dense, slight plasticity, with fine grained sand						87
20											
25											
30											
35											
40											

End of Boring at 16.5 ft
Anticipated Groundwater 10.0 ft

** Blows not corrected for overburden pressure, sampler size or increase drive energy for automatic hammers.

Project No: LE06111

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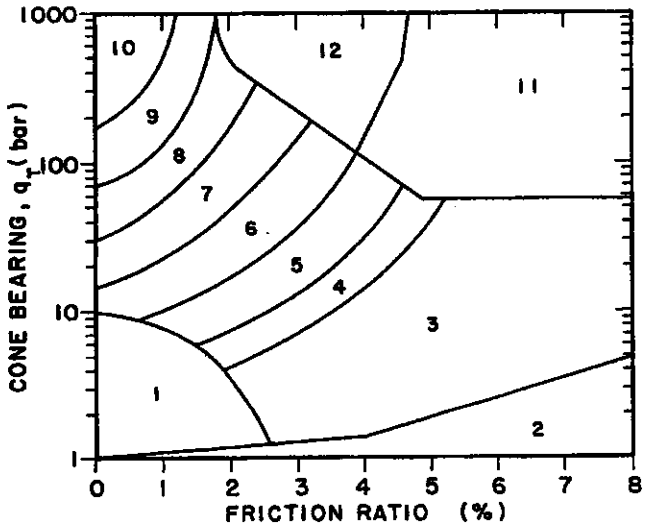
Plate B-3

Simplified Soil Classification Chart

After Robertson & Campanella (1989)



Geotechnical Parameters from CPT Data:

Equivalent SPT N(60) blow count = Qc/(Qc/N Ratio)

N1(60) = Cn*N(60) Normalized SPT blow count

Cn = 1/(p'o)^0.5 < 1.6 max. from Liao & Whitman (1986)

p'o = effective overburden pressure (tsf) using unit densities given below and estimated groundwater table.

Dr = Relative density (%) from Jamiolkowski et. al. (1986) relationship
= -98 +68*log(Qc/p'o^0.5) where Qc, p'o in tonne/sqm

Note: 1 tonne/sqm = 0.1024 tsf, 1 bar =1.0443 tsf

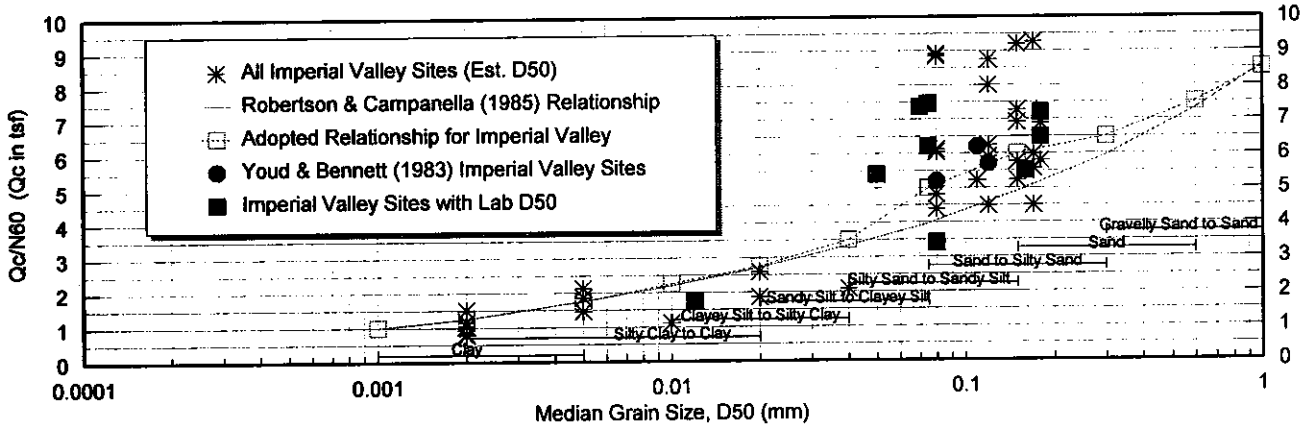
Phi = Friction Angle estimated from either:

1. Roberton & Campanella (1983) chart:
   Phi = 5.3 + 24*(log(Qc/p'o))+3(log(Qc/p'o))^2
2. Peck, Hansen & Thornburn (1974) N-Phi Correlation
3. Schmertman (1978) chart [Phi = 28+0.14*Dr for fine uniform sands]

Su = undrained shear strength (tsf)
= (Qc-p'o)/Nk where Nk varies from 10 to 22, 17 for OC clays

OCR = Overconsolidation Ratio estimated from Schmertman (1978) chart using Su/p'o ratio and estimated normal consolidated Su/p'o

Variation of Qc/N Ratio with Grain Size



Note: Assumed Properties and Adopted Qc/N Ratio based on correlations from Imperial Valley, California soils

Table of Soil Types and Assumed Properties

Zone	Soil Classification	UCS	Density (pcf)	R&C Qc/N	Adopted Qc/N	Est. PI	Fines (%)	D50 (mm)	Su (tsf)	Consistency
1	Sensitive fine grained	ML	120	2	2	NP-15	65-100	0.020	0-0.13	very soft
2	Organic Material	OL/OH	120	1	1	--	--	--	0.13-.25	soft
3	Clay	CL/CH	125	1	1.25	25-40+	90-100	0.002	0.25-0.5	firm
4	Silty Clay to Clay	CL	125	1.5	2	15-40	90-100	0.010	0.5-1.0	stiff
5	Clayey Silt to Silty Clay	ML/CL	120	2	2.75	5-25	90-100	0.020	1.0-2.0	very stiff
6	Sandy Silt to Clayey Silt	ML	115	2.5	3.5	NP-10	65-100	0.040	>2.0	hard
7	Silty Sand to Sandy Silt	SM/ML	115	3	5	NP	35-75	0.075	Dr (%)	Relative Density
8	Sand to Silty Sand	SP/SM	115	4	6	NP	5-35	0.150	0-15	very loose
9	Sand	SP	110	5	6.5	NP	0-5	0.300	15-35	loose
10	Gravelly Sand to Sand	SW	115	6	7.5	NP	0-5	0.600	35-65	medium dense
11	Overconsolidated Soil	--	120	1	1	NP	90-100	0.010	65-85	dense
12	Sand to Clayey Sand	SP/SC	115	2	2	NP-5	--	---	>85	very dense

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Key to CPT Interpretation of Logs

Plate B-4

DEFINITION OF TERMS

PRIMARY DIVISIONS			SYMBOLS		SECONDARY DIVISIONS
Coarse grained soils More than half of material is larger than No. 200 sieve	Gravels More than half of coarse fraction is larger than No. 4 sieve	Clean gravels (less than 5% fines)		GW	Well graded gravels, gravel-sand mixtures, little or no fines
				GP	Poorly graded gravels, or gravel-sand mixtures, little or no fines
		Gravel with fines		GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines
	Sands More than half of coarse fraction is smaller than No. 4 sieve	Clean sands (less than 5% fines)		SW	Well graded sands, gravelly sands, little or no fines
				SP	Poorly graded sands or gravelly sands, little or no fines
		Sands with fines		SM	Silty sands, sand-silt mixtures, non-plastic fines
				SC	Clayey sands, sand-clay mixtures, plastic fines
Fine grained soils More than half of material is smaller than No. 200 sieve	Silts and clays Liquid limit is less than 50%			ML	Inorganic silts, clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity, gravely, sandy, or lean clays
				OL	Organic silts and organic clays of low plasticity
	Silts and clays Liquid limit is more than 50%			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
				CH	Inorganic clays of high plasticity, fat clays
				OH	Organic clays of medium to high plasticity, organic silts
Highly organic soils				PT	Peat and other highly organic soils

GRAIN SIZES

Silts and Clays	Sand			Gravel		Cobbles	Boulders
	Fine	Medium	Coarse	Fine	Coarse		

200 4 10 4 3/4" 3" 12"

US Standard Series Sieve — Clear Square Openings

Sands, Gravels, etc.	Blows/ft. *
Very Loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	Over 50

Clays & Plastic Silts	Strength **	Blows/ft. *
Very Soft	0-0.25	0-2
Soft	0.25-0.5	2-4
Firm	0.5-1.0	4-8
Stiff	1.0-2.0	8-16
Very Stiff	2.0-4.0	16-32
Hard	Over 4.0	Over 32

* Number of blows of 140 lb. hammer falling 30 inches to drive a 2 inch O.D. (1 3/8 in. I.D.) split spoon (ASTM D1586).

** Unconfined compressive strength in tons/s.f. as determined by laboratory testing or approximated by the Standard Penetration Test (ASTM D1586), Pocket Penetrometer, Torvane, or visual observation.

Type of Samples:

Ring Sample | Standard Penetration Test | Shelby Tube | Bulk (Bag) Sample

Drilling Notes:

1. Sampling and Blow Counts
   - Ring Sampler - Number of blows per foot of a 140 lb. hammer falling 30 inches.
   - Standard Penetration Test - Number of blows per foot.
   - Shelby Tube - Three (3) inch nominal diameter tube hydraulically pushed.
2. P. P. = Pocket Penetrometer (tons/s.f.).
3. NR = No recovery.
4. GWT = Ground Water Table observed @ specified time.

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Key to Logs

Plate B-5

APPENDIX C

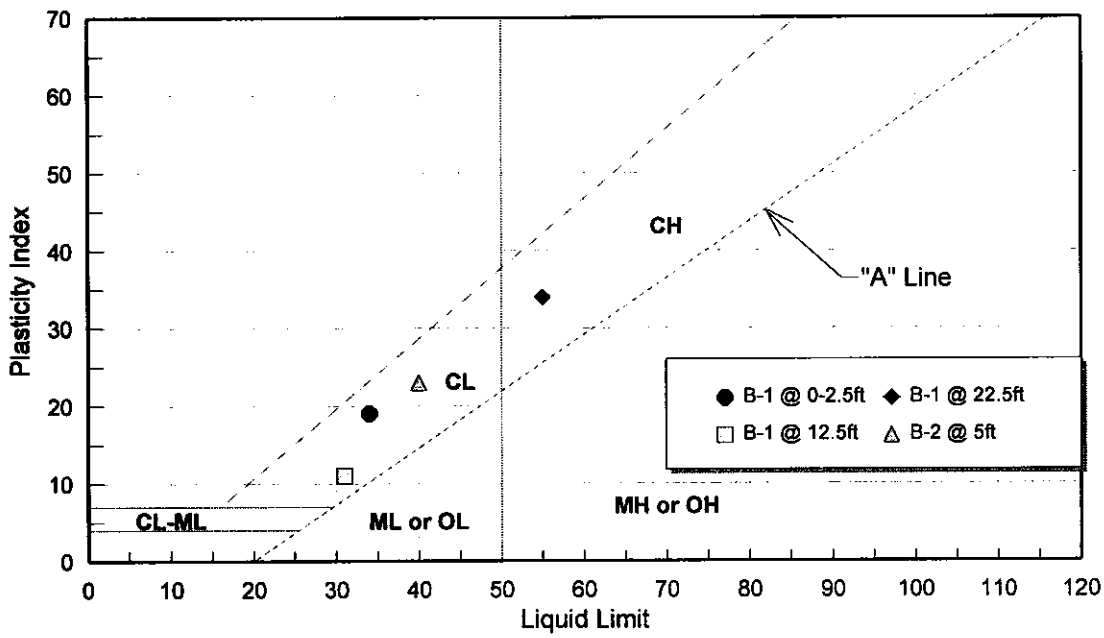
LANDMARK CONSULTANTS, INC.

CLIENT: The Holt Group
PROJECT: Imperial WWTP Upgrades, Imperial, CA
JOB NO: LE06111
DATE: 04/14/06

ATTERBERG LIMITS (ASTM D4318)

Sample Location	Sample Depth (ft)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Classif-ation
B-1	0-2.5	34	15	19	CL
B-1	12.5	31	20	11	CL
B-1	22.5	55	21	34	CH
B-2	5	40	17	23	CL

PLASTICITY CHART



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Project No: LE06111

Atterberg Limits Test Results

Plate C-1

LANDMARK CONSULTANTS, INC.

CLIENT: The Holt Group
PROJECT: Imperial WWTP Upgrades, Imperial, CA
JOB NO: LE06111
DATE: 04/14/06

CHEMICAL ANALYSES

Boring:	B-1	B-2	CalTrans Method
Sample Depth, ft:	0-2.5	0-5	
pH:	8.2	8.2	643
Electrical Conductivity (mmhos):	4.9	1.5	424
Resistivity (ohm-cm):	75	390	643
Chloride (Cl), ppm:	16,480	1,000	422
Sulfate (SO4), ppm:	2,844	1,942	417

General Guidelines for Soil Corrosivity

Material Affected	Chemical Agent	Amount in Soil (ppm)	Degree of Corrosivity
Concrete	Soluble Sulfates	0 -1,000	Low
		1,000 - 2,000	Moderate
		2,000 - 20,000	Severe
		> 20,000	Very Severe
Normal Grade Steel	Soluble Chlorides	0 - 200	Low
		200 - 700	Moderate
		700 - 1,500	Severe
		> 1,500	Very Severe
Normal Grade Steel	Resistivity	1-1,000	Very Severe
		1,000-2,000	Severe
		2,000-10,000	Moderate
		> 10,000	Low

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Project No: LE06111

Selected Chemical Analyses Results

Plate C-2

APPENDIX D

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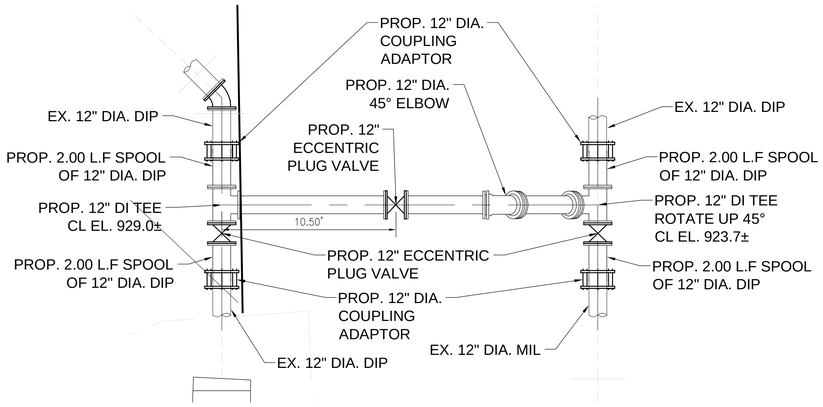
APPENDIX B

CLARIFIER PIPE MODIFICATIONS



PROPOSED 12" DIA. D.I.P. CONNECTION

DETAIL 2

N.T.S.

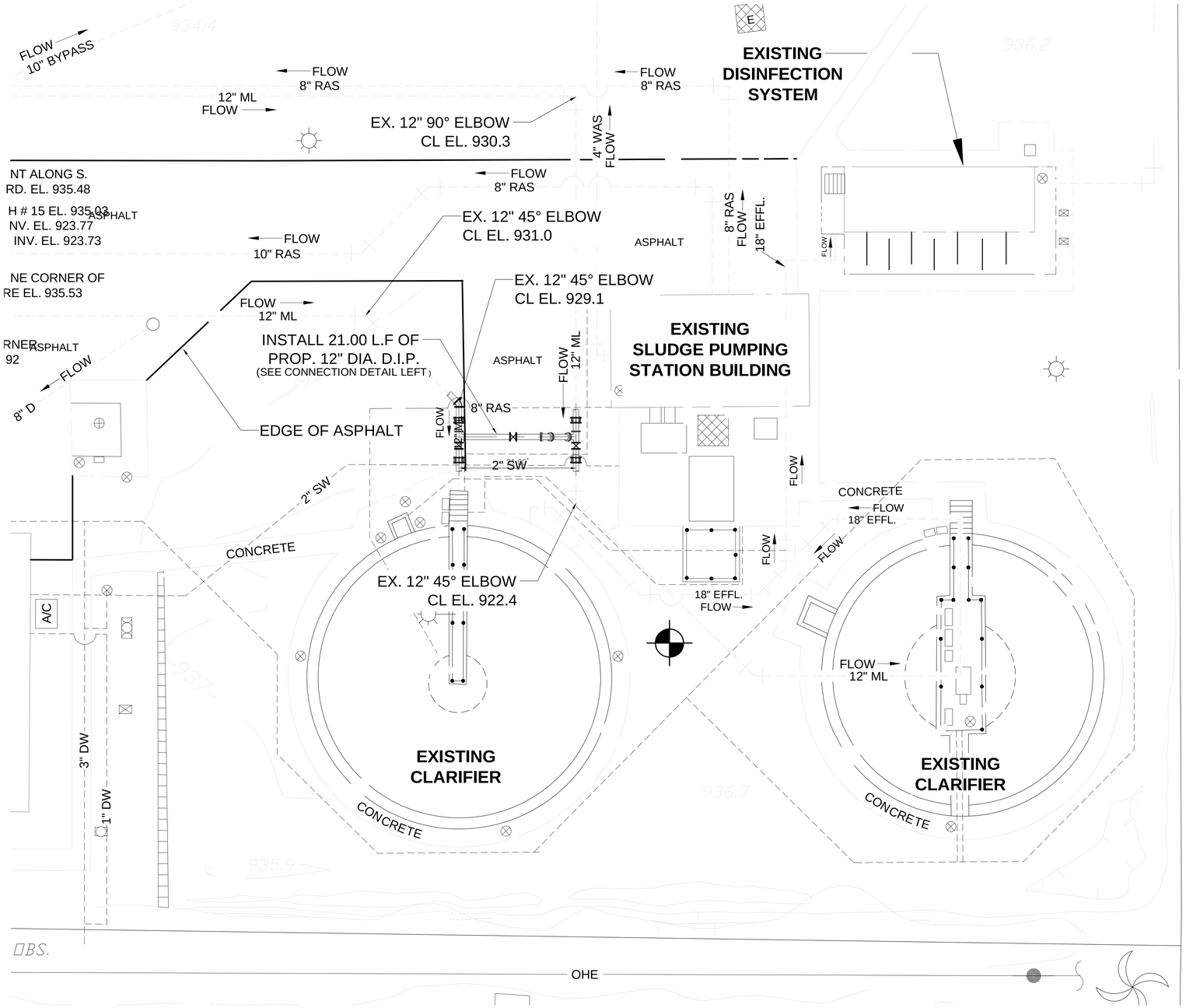
CONSTRUCTION NOTES

1. 12-INCH DIA. DUCTILE IRON PIPE, CL 53 WATERLINE.
2. 12-INCH DIA. FLANGED ECCENTRIC PLUG VALVE
3. 12-INCH DIA. FLANGED DI TEE
4. 12-INCH DIA. COUPLING ADAPTOR

GENERAL PIPELINE NOTES

1 DUCTILE IRON PIPE AND FITTINGS SHALL BE CEMENT MORTAR LINED CL 53 UNLESS OTHERWISE SPECIFIED. ALL DUCTILE IRON PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED PER AWWA C105, CONTRACTOR TO PROVIDE WRAP.

2 ALL BURIED VALVES SHALL BE INSTALLED WITH AN ADJUSTABLE VALVE BOX WITH A RISER STEM, WHICH SHALL BRING THE VALVE NUT TO WITHIN 3 FT OF THE FINAL GROUND SURFACE.



ISSUED FOR BID

R:\W01\2012\12-0081\DRAWINGS\PIPING MODIFICATIONS\12-0081-C-SP-PIPING-SH3.DWG 10/28/2010 10:26 AM

Underground Service Alert

DIG ALERT BEFORE YOU DIG

Call:TOLL FREE 1-800 227-2600

TWO WORKING DAYS BEFORE YOU DIG

REVISIONS

NO.	DATE	INITIAL	DESCRIPTION	APPROVED/DATE

DESIGNED BY: | DRAWN BY: | CHECKED BY:

CITY OF IMPERIAL, CALIF. 1904

CITY OF IMPERIAL

CITY ENGINEER DATE

REFERENCES

ENGINEER'S SEAL

REGISTERED PROFESSIONAL ENGINEER SHANE L. BLOOMFIELD NO. C77435 CIVIL STATE OF CALIFORNIA

ALBERT A. WEBB ASSOCIATES
ENGINEERING CONSULTANTS
36951 COOK STREET #103
PALM DESERT, CA 92211
PH. (760) 568-5005
FAX (760) 568-3443

PLANS PREPARED UNDER THE SUPERVISION OF:

SHANE L. BLOOMFIELD DATE
REGISTERED CIVIL ENGINEER NO. C77435

		DATE
DESIGNED:	–	10/1/12
DRAWN:	AE	10/1/12
TRACED:	–	N/A
CHECKED:	SLB	10/1/12
SUBMITTED:		--/--/--
SCALE:		

HORIZ. SCALE: 1"=10'
VERT. SCALE: N/A

CITY OF IMPERIAL
IMPERIAL COUNTY, CALIFORNIA

WASTEWATER TREATMENT PLANT MODIFICATIONS
CLARIFIER PIPE MODIFICATIONS
SITE PLAN AND DETAILS

BID NO. 2014-01

SHEET 1 OF 1

CP-1