



STATE OF UTAH - DEPARTMENT OF ADMINISTRATIVE SERVICES

Division of Facilities Construction and Management

DFCM

**MULTI-STEP BIDDING PROCESS
FOR
GENERAL CONTRACTORS**

Single Project---Short-Listing

Request for Submittals

October 13, 2010

**SPRING REDEVELOPMENT
LOA FISH HATCHERY**

**DIVISION OF WILDLIFE RESOURCES
WAYNE COUNTY, UTAH**

DFCM Project Number 10050520

Sunrise Engineering
11 North 300 West
Washington, Utah 84780

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Current copies of the following documents are hereby made part of these contract documents by reference. These documents are available on the DFCM web site at <http://dfcm.utah.gov/StdDocs/index.html> "Standard Documents" – "Reference Documents I" – "Item 7. Supplemental General Conditions" or are available upon request from DFCM:

DFCM Supplemental General Conditions dated July 1, 2010 *
DFCM Supplemental General Conditions revised May 11, 2010
DFCM Supplemental General Conditions dated July 1, 2009
DFCM Supplemental General Conditions dated July 15, 2008
DFCM General Conditions dated May 25, 2005

*** NOTE: THE NEW SUPPLEMENTAL GENERAL CONDITIONS EFFECTIVE JULY 1, 2010 ADDRESSING DRUG AND ALCOHOL TESTING ARE REFERENCED AT THE LINK ABOVE.**

The Agreement and General Conditions dated May 25, 2005 have been updated from versions that were formally adopted and in use prior to this date. The changes made to the General Conditions are identified in a document entitled Revisions to General Conditions that is available on DFCM's web site at <http://dfcm.utah.gov>

NOTICE TO CONTRACTORS

The State of Utah - Division of Facilities Construction and Management (DFCM) is requesting submissions for the following project:

Project Name: Spring Redevelopment – Loa Fish Hatchery
Division of Wildlife Resources – Wayne County, Utah

Project No. 10050520

Project Description: Provide spring and stream alteration and redevelopment to the hatchery to maximize spring flow production.

Cost Estimate: \$313,250.00

DFCM is entering into a Multi-Step Bidding Process for Construction services. A short-listing of contractors will be based on the selection criteria outlined in the bidding documents contained herein. Short-listed contractors will be invited to submit bids on the project described above. **The only contractors allowed to bid on this project will be contractors short-listed by the selection committee.**

All contractors responding to this procurement must comply with and require all of their subcontractors to comply with the license laws as required by the State of Utah.

The bidding documents including plans and specification, short-listing requirements and schedule will be available at 4:00 PM on Wednesday, October 13, 2010 on the DFCM web page at <http://dfcm.utah.gov> and from DFCM, 4110 State Office Building, Salt Lake City, Utah 84114, telephone 801-538-3018. For questions regarding this solicitation, please contact Bob Anderson, DFCM, at 801-652-6754. No others are to be contacted regarding this solicitation.

A **mandatory** pre-submittal meeting to discuss the multi-step bidding process will be held at 10:00 AM on Thursday, October 21, 2010 at the DFCM Conference Room, 4112 State Office Building, Salt Lake City, Utah.

When bidding on this project, short-listed contractors will be required to submit a Bid Bond in the amount of five percent (5%) of the bid amount, made payable to the Division of Facilities Construction and Management on DFCM's Bid Bond Form. A Bid Bond must accompany each bid.

The Division of Facilities Construction & Management reserves the right to reject any or all submittals/bids or to waive any formality or technicality in any submittal/bid in the interest of the State.

DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT
MARLA WORKMAN, CONTRACT COORDINATOR
4110 State Office Bldg., Salt Lake City, Utah 84114

DESCRIPTION OF WORK

The only contractors allowed to bid on this project will be contractors short-listed by the selection committee.

The project is located at the DWR Loa Fish Hatchery in Wayne County, 17 miles North on SR 72, Fremont, Utah. The project comprises the following:

- Removal and disposal of existing concrete dikes, if possible.
- Exploration work necessary to expose water-producing strata within the construction zone.
- Installation of new spring collection trenches and pipe segments with associated materials and appurtenances, and the spring collection box so the system is not surfaced exposed.
- Connections to existing hatchery building and raceway pipe infrastructure.
- Construction of a bypass line for the spring collection system discharge, if possible.
- Protection of system from invasive species and also endemic snail is mandatory.

Individual contractors or alliances between two or more contractors are allowed in this process to form a team. However, one contractor or firm MUST be declared as the lead firm representing the team. If the team is short-listed through this multi-step process, the state will only enter into contracts with the lead contractor or firm. The lead contractor or firm must be licensed by the State of Utah and comply with and require all of its subcontractors to comply with the license laws as required by the State of Utah.

MULTI-STEP BIDDING PROCESS SHORT-LISTING OF GENERAL CONTRACTORS

The short-listing of contractors will be based on the selection criteria outlined in this document.

1. Multi-Step Bidding Documents

The Multi-Step bidding documents consist of all of the information contained in this solicitation and all documents listed in the Table of Contents. All said documents are incorporated in this document by reference.

2. Availability of Documents

Bidding documents are available free of charge at the locations stated on the Schedule. The bidding documents are also available at DFCM's internet web site at <http://dfcm.utah.gov>.

3. Drawings and Specifications and Interpretations

Drawings, specifications and other contract documents may be obtained as stated in the Notice to Contractors. If any firm is in doubt as to the meaning or interpretation of any part of the drawings, specifications, scope of work or contract documents, they shall submit, in writing, a request for interpretation to the authorized DFCM representative by the deadline identified in the schedule. Answers to questions and interpretations will be made via addenda issued by DFCM. Neither DFCM nor the designer shall be responsible for incorrect information obtained by contractors from sources other than the official drawings/specifications and addenda issued by DFCM.

4. Contact Information

Except as authorized by the DFCM Representative or as otherwise stated in the bidding documents or the pre-submittal meeting, communication during the multi-step bidding process shall be directed to the specified DFCM's Representative. In order to maintain the fair and equitable treatment of everyone, contractors shall not unduly contact or offer gifts or gratuities to owners, users or selection committee members in an effort to influence the selection process or in a manner that gives the appearance of influencing the selection process. This prohibition applies before the bidding documents are issued as the project is developed, and extends through the award of a contract. Failure to comply with this requirement may result in a disqualification from the multi-step bidding process. Contractors should be aware that selection committee members will be required to certify that they have not been contacted by any of the contractors in an attempt to influence the selection process.

5. Requests for Information

All requests for information shall be in writing and directed to:

Project Manager: Bob Anderson
Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114
E-mail: bobanderson@utah.gov
Phone: 801-652-6754
Facsimile: 801-538-3267

6. **Schedule**

The Schedule lists the important events, dates, times and locations of meetings and submittals that must be met by the contractor.

7. **Pre-Submittal Meeting**

A **mandatory** pre-submittal meeting will be held on the date and time and at the location listed on the Schedule. During the meeting, questions will be answered about the multi-step bidding process. Questions about the project, plans and specifications will also be addressed. Attendance at this meeting is mandatory for General Contractors.

8. **Submittal Due Dates and Times**

All required submittals must be delivered to, and received by, the Division of Facilities Construction and Management by the time deadline established in the Schedule. Submittals received after the specified time deadline will not be accepted. Please allow adequate time for delivery. If using a courier service, the contractor is responsible for ensuring that delivery will be made directly to the required location prior to the deadline.

9. **Last Day to Submit Questions**

Questions must be submitted in writing to the DFCM project manager by the deadline listed on the Schedule.

10. **Addendum**

All clarifications will be in writing and issued as addenda to the RFS. Addenda will be posted on DFCM's web site at <http://dfcm.utah.gov>. **Contractors are responsible for obtaining information contained in the addenda from the web site. Any addenda issued prior to the submittal deadline shall become part of the multi-step bidding process and any information required must be included in the contractor's submittal.** Addenda issued prior to the submittal deadline shall become part of the bidding process and must be acknowledged on the bid form. Failure to acknowledge addenda may result in disqualification from bidding. DFCM shall not be responsible for incorrect information obtained by contractors from sources other than official addenda issued by DFCM.

11. **Bid Bond Requirements**

A bid bond properly signed by a qualified surety, as indicated on the DFCM Bid Bond form provided along with this Instruction to Bidders, in the amount of 5% of the bid, shall accompany the bid submission to DFCM. **THIS BID BOND MUST BE ON THE DFCM BID BOND FORM PROVIDED WITH THIS INSTRUCTION TO BIDDERS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID** unless only one bid is received by DFCM, or the failure to comply with the bid bond requirements is determined by the Director of DFCM to be nonsubstantial based on the following:

- A. the bid bond is submitted on a form other than DFCM's required Bid Bond form and the bid bond meets all other requirements including being issued by a surety firm authorized to do business in the State of Utah and be listed in the U.S. Department of the Treasury Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies for an amount not less than the amount of the bond to be issued. A co-surety may be utilized to satisfy this requirement; and

- B. the contractor provides a bid bond properly signed by a qualified surety and on the required DFCM Bid Bond form by the close of business of the next succeeding business day after the DFCM notifies the bidder of the defective bid bond.

12. Performance and References

DFCM will rate each firm's performance on every project worked on (rating scale: 1 = low; 5 = high). The rating may include comments from agencies. The firm will have an opportunity to review and comment on their ratings. Ratings on DFCM projects over the previous five years will be provided to the selection committee for their consideration in evaluating and scoring the past performance of each firm. If a firm has not completed at least three DFCM projects in the last five years, they shall provide by the time indicated on the Schedule, a list of references on additional projects for a total of five projects. References should include: (a) name and address of the project; (b) name and phone number of the person able to answer questions about the project; (c) date of when the work was completed; (d) the cost of the project and the type of project (school, office, warehouse, etc).

13. Statement of Qualifications

The Contractor (firm) shall provide five copies of a statement of qualifications by the time indicated on the Schedule. The statement should describe: (a) the financial viability of your firm; (b) the experience, skill level and qualifications of your firm - identify the specific project manager and site superintendent that will be assigned to this project; (c) provide examples of similar projects completed by your firm and the specific project manager and site superintendent that will be assigned to this project; (d) describe your firm's areas of expertise and other special qualifications as they pertain to this project; (e) document your firm's track record of completing projects on time and within budget; (f) explain your firm's reputation and commitment to high-quality workmanship; and (g) document your firm's ability to comply with the bonding requirements outlined earlier in this document. The statement of qualifications should be concise (**limit three pages**) yet contain sufficient information for evaluation by the selection committee. Note: If multiple firms combine to form a team, only the lead contractor or firm will be allowed to bid on projects. In addition, if any member of the team (contractor or firm) withdraws from the team, the entire team is disqualified and will not be allowed to bid.

14. Termination or Debarment Certification

Each firm must submit a certification that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from soliciting work by any governmental department or agency. The firm must also certify that neither the firm nor its principals have been terminated during the performance of a contract or withdrew from a contract to avoid termination. If the firm cannot certify to these statements, the firm shall submit a written explanation. Firms are to submit the certifications with their Statement of Qualifications.

15. Project Management Plan

Each Contractor (firm) shall provide five copies of a document describing their management plan by the time indicated on the Schedule. The document should include: (a) the process used for selecting and managing subcontractors; (b) a description of how the your firm is organized - pertaining to this project, document who will be in charge with decision making authority; (c) a project schedule detailing your firm's plan to ensure that the project will be completed on time (include timeline for ordering long lead materials and equipment); (d) a description of the process (action plan) your firm will take to bring the

project back on schedule if it falls behind; (e) the procedures your firm has in place to minimize change orders; (f) the methodology used to ensure the accuracy of your bid; (g) your firm's approach to site security and project safety; (h) your firm's understanding of DFCM's construction general conditions and contract requirements; and (i) any other information that will assist the selection committee in evaluating your firm's approach to project management.

Include an organization chart of key personnel and a description of their duties. The management plan document should be concise (**limit three pages**) yet contain sufficient information for evaluation by the selection committee. The organization chart is a separate document and is not counted as one of the three pages.

16. Selection Committee

The selection committee will evaluate and score each firm/team. Committee members may include individuals from DFCM, User Agency/Institution, and a representative from the design or construction disciplines.

17. Interviews

If interviews are required, firms will be notified of the date and time of their interview. Otherwise, the selection committee reserves the right to short-list firms/teams based on their submitted past performance ratings/references, statement of qualifications and project management plan.

If necessary, interviews will be conducted with all responsive and responsible contractors. Firms that are late or do not appear for the interview may be disqualified by the committee. The evaluation will be made using the selection criteria contained in this document. Information provided by the past performance/references, statement of qualifications, project management plan and the interview will be evaluated using the selection criteria as the basis for the selection. The purpose of the interview is to allow contractors an opportunity to present their qualifications, discuss past performance/references and describe their project management plan. It will also provide an opportunity for the selection committee to ask questions about these items. Firms may elect to have management personnel, project managers and superintendents in attendance. Attendance of subcontractors is at the discretion of the contractor. The method of presentation is at the discretion of the contractor.

18. Selection Criteria

The following criteria and weighting will be used in evaluating each firm/team. The selection committee will consider all criteria in performing a comprehensive evaluation of each firm/team. Each firm/team will be scored by each selection committee member in the categories listed below.

- A. Performance Rating/References.** The committee will receive a past performance rating and/or reference score for each firm/team. DFCM will compute the score for each firm/team based upon the information outlined earlier in this document. **Possible Points: 30**
- B. Statement of Qualifications.** The committee will evaluate and score each firm's/team's qualifications in accordance with the information outlined earlier in this document as well as additional information about the firm's/team's qualifications presented during the interview. **Possible Points: 30**

- C. Project Management Plan.** The committee will evaluate and score each firm's/team's project management approach in accordance with the information outlined earlier in this document as well as additional information about the firm's/team's project management approach presented during the interview. **Possible Points: 30**

The following criteria are project specific. They are added to the above criteria in determining the selection that represents the best value for the state.

- D. Experience.** In the construction/renovation of similar projects related to or detailed to spring redevelopment work. **Possible Points: 10**

TOTAL POINTS = 100 POINTS

19. Short-Listing

DFCM will **short-list all firms** receiving a score of 85 points or above from the selection committee. No firms receiving fewer than 85 points will be short-listed. Only short-listed firms will be invited to bid on this project. During the bidding process, the final contractor selection will be based on the lowest responsive and responsible bidder.

20. Product Approvals

Where reference is made to one or more proprietary products in the contract documents, but restrictive descriptive materials of one or more manufacturer(s) is referred to in the contract documents, the products of other manufacturers will be accepted, provided they equal or exceed the standards set forth in the drawings and specifications and are compatible with the intent and purpose of the design, subject to the written approval of the Designer. Such written approval must occur prior to the deadline established for the last scheduled addendum to be issued. The Designer's written approval will be included as part of the addendum issued by DFCM. If the descriptive material is not restrictive, the products of other manufacturers specified will be accepted without prior approval provided they are compatible with the intent and purpose of the design as determined by the Designer.

21. Trade Secrets or Confidential Matters

Any submitter may designate those portions of the submittals which contain trade secrets or other confidential matters that the Governmental Records and Access Management Act (GRAMA) would allow to be a protected record. Any disclosure of submittals or portions thereof shall be in accordance with GRAMA and State law.

22. Financial Responsibility of Contractors, Subcontractors and Sub-subcontractors

Contractors shall respond promptly to any inquiry in writing by DFCM to any concern of financial responsibility of the Contractor, Subcontractor or Sub-subcontractor. Failure to respond may result in the Contractor (firm) receiving a poor performance rating on this project.

23. Licensure

The Contractor shall comply with and require all of its Subcontractors to comply with the license laws as required by the State of Utah.

24. Permits

In concurrence with the requirements for permitting in the General Conditions, it is the responsibility of the Contractor to obtain the fugitive dust plan requirements from the Utah Division of Air Quality and the SWPPP requirements from the Utah Department of Environmental Quality and submit the completed forms and pay any permit fee that may be required for this specific project. Failure to obtain the required permit may result in work stoppage and/or fines from the regulating authority that will be the sole responsibility of the Contractor. Any delay to the project as a result of any such failure to obtain the permit or noncompliance with the permit shall not be eligible for any extension in the Contract Time.

25. Time is of the Essence

Time is of the essence in regard to all the requirements of the contract documents.

26. Bids

Before submitting a bid, each bidder shall carefully examine the contract documents; shall visit the site of the work; shall fully inform themselves as to all existing conditions and limitations; and shall include in the bid the cost of all items required by the contract documents including those added via addenda. If the bidder observes that portions of the contract documents are at variance with applicable laws, building codes, rules, regulations or contain obvious erroneous or uncoordinated information, the bidder shall promptly notify the DFCM Project Manager. Changes necessary to correct these issues will be made via addenda issued by DFCM.

The bid, bearing original signatures, must be typed or handwritten in ink on the Bid Form provided in the procurement documents and submitted in a sealed envelope at the location specified by the Notice to Contractor's prior to the published deadline for the submission of bids.

Bid bond security, in the amount of five percent (5%) of the bid, made payable to the Division of Facilities Construction and Management, shall accompany bid. **THE BID BOND MUST BE ON THE BID BOND FORM PROVIDED IN THE PROCUREMENT DOCUMENTS IN ORDER TO BE CONSIDERED AN ACCEPTABLE BID.**

If the bid bond security is submitted on a form other than the Owner's required bid bond form, and the bid security meets all other legal requirements, the bidder will be allowed to provide an acceptable bid bond by the close of business on the next business day following notification by DFCM of submission of a defective bid bond security. **A cashier's check cannot be used as a substitute for a bid bond.**

27. Listing of Subcontractors

Listing of Subcontractors shall be as summarized in the "Instructions and Subcontractors List Form", included as part of the contract documents. The Subcontractors List shall be delivered to DFCM or faxed to DFCM at (801)538-3677 within 24 hours of the bid opening. Requirements for listing additional subcontractors will be listed in the contract documents.

DFCM retains the right to audit or take other steps necessary to confirm compliance with requirements for the listing and changing of subcontractors. Any contractor who is found to not be in compliance with these requirements may receive a poor performance rating on this project.

28. Contract and Bond

The Contractor's Agreement will be in the form provided in this document. The contract time will be as indicated in the bid. The successful bidder, simultaneously with the execution of the Contract Agreement, will be required to furnish a performance bond and a payment bond, both bearing original signatures, upon the forms provided in the procurement documents. The performance and payment bonds shall be for an amount equal to one hundred percent (100%) of the Contract Sum and secured from a company that meets the requirements specified in the requisite forms. Any bonding requirements for Subcontractors will be specified in the Supplementary General Conditions.

29. Award of Contract

The Contract will be awarded as soon as possible to the lowest, responsive and responsible bidder, based on the lowest combination of base bid and acceptable prioritized alternates, provided the bid is reasonable, is in the interests of DFCM to accept and after applying the Utah Preference Laws in U.C.A. Title 63, Chapter 56. DFCM reserves the right to waive any technicalities or formalities in any bid or in the bidding. Alternates will be accepted on a prioritized basis with Alternate 1 being highest priority, Alternate 2 having second priority, etc.

30. Right to Reject Bids

DFCM reserves the right to reject any or all Bids.

31. Withdrawal of Bids

Bids may be withdrawn on written request received from bidders within 24 hours after the bid opening if the contractor has made an error in preparing the bid.



MULTI-STEP PROJECT SCHEDULE

PROJECT NAME: SPRING REDEVELOPMENT – LOA FISH HATCHERY				
DIVISION OF WILDLIFE RESOURCES – WAYNE COUNTY, UTAH				
DFCM PROJECT NO. : 10050520				
Event	Day	Date	Time	Place
Document Available, including Plans and Specifications	Wednesday	October 13, 2010	4:00 PM	DFCM 4110 State Office Building SLC, UT and DFCM web site*
Mandatory Pre-Submittal Meeting	Thursday	October 21, 2010	10:00 AM	DFCM Conference Room 4112 State Office Building SLC, UT
Last Day to Submit Questions on Shortlisting (In Writing)	Tuesday	October 26, 2010	4:00 PM	Bob Anderson- DFCM E-mail bobanderson@utah.gov
Addendum on Shortlisting	Thursday	October 28, 2010	4:00 PM	DFCM web site*
List of References, Statement of Qualifications, Project Management Plan, and Termination/Debarment Certification Due	Tuesday	November 2, 2010	12:00 NOON	DFCM 4110 State Office Building SLC, UT
Selection Committee Review	Tuesday	November 9, 2010	To Be Announced	To Be Announced
Short-List Announced	Wednesday	November 10, 2010	4:00 PM	DFCM web site*
Notice: Only Short-Listed Firms Will Be Allowed To Bid On This Project				
Mandatory Site Visit	Tuesday	November 16, 2010	11:00 AM	Loa Fish Hatchery 17 miles North on SR 72 Fremont, UT
Last Day to Submit Questions (In Writing)	Tuesday	November 23, 2010	4:00 PM	Bob Anderson - DFCM E-mail bobanderson@utah.gov
Final Addendum (exception for bid delays)	Monday	November 29, 2010	12:00 NOON	DFCM web site*
Prime Contractors Turn in Bid and Bid Bond/Bid Opening in DFCM Conference Room	Wednesday	December 1, 2010	3:00 PM	DFCM 4110 State Office Building SLC, UT
Subcontractors List and Bid Schedule Due	Thursday	December 2, 2010	3:00 PM	DFCM 4110 State Office Building SLC, UT Fax 801-538-3677
Project Completion	Friday	February 25, 2011	4:00 PM	

* DFCM’s web site address is <http://dfcm.utah.gov>



BID FORM

NAME OF BIDDER _____ DATE _____

To the Division of Facilities Construction and Management
4110 State Office Building
Salt Lake City, Utah 84114

The undersigned, responsive to the "Notice to Contractors" and in accordance with the "Instructions to Bidders", in compliance with your invitation for bids for the **SPRING REDEVELOPMENT - LOA FISH HATCHERY DIVISION OF WILDLIFE RESOURCES – WAYNE COUNTY, UTAH - DFCM PROJECT NO. 10050520** and having examined the Contract Documents and the site of the proposed Work and being familiar with all of the conditions surrounding the construction of the proposed Project, including the availability of labor, hereby proposes to furnish all labor, materials and supplies as required for the Work in accordance with the Contract Documents as specified and within the time set forth and at the price stated below. This price is to cover all expenses incurred in performing the Work required under the Contract Documents of which this bid is a part:

I/We acknowledge receipt of the following Addenda: _____

BASE BID: For all work shown on the Drawings and described in the Specifications, Contract Documents, and Items 1 – 20 on the attached Bid Schedule, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____)
(In case of discrepancy, written amount shall govern)

ADDITIVE ALTERNATE NO. 1: For all work shown on the Drawings and described in the Specifications, Contract Documents, and Item 21 on the attached Bid Schedule to install 18” bypass line, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____)
(In case of discrepancy, written amount shall govern)

ADDITIVE ALTERNATE NO. 2: For all work shown on the Drawings and described in the Specifications, Contract Documents, and Item 22 on the attached Bid Schedule to provide/install one turbulent fountain, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____)
(In case of discrepancy, written amount shall govern)

ADDITIVE ALTERNATE NO. 3: For all work shown on the Drawings and described in the Specifications, Contract Documents, and Item 23 on the attached Bid Schedule to remove, dispose, and fill existing raceways, I/we agree to perform for the sum of:

_____ DOLLARS (\$_____)
(In case of discrepancy, written amount shall govern)

I/We guarantee that the Work will be Substantially Complete by **February 25, 2011** should I/we be the successful bidder, and agree to pay liquidated damages in the amount of **\$250.00** per day for each day after expiration of the Contract Time as stated in Article 3 of the Contractor's Agreement.

This bid shall be good for 45 days after bid opening.

Enclosed is a 5% bid bond, as required, in the sum of _____

The undersigned Contractor's License Number for Utah is _____.

Upon receipt of notice of award of this bid, the undersigned agrees to execute the contract within ten (10) days, unless a shorter time is specified in the Contract Documents, and deliver acceptable Performance and Payment bonds in the prescribed form in the amount of 100% of the Contract Sum for faithful performance of the contract.

The Bid Bond attached, in the amount not less than five percent (5%) of the above bid sum, shall become the property of the Division of Facilities Construction and Management as liquidated damages for delay and additional expense caused thereby in the event that the contract is not executed and/or acceptable 100% Performance and Payment bonds are not delivered within the time set forth.

Type of Organization: _____ (Corporation, Partnership, Individual, etc.)

Any request and information related to Utah Preference Laws: _____

Respectfully submitted,

Name of Bidder

ADDRESS:

Authorized Signature

LOA FISH HATCHERY SPRING REDEVELOPMENT BID SCHEDULE

CONTRACT FOR: Utah DFCM & Utah DWR, Loa Fish Hatchery Spring Redevelopment

The undersigned Bidder, having examined and determined the scope of the Contract Documents, hereby proposes to perform the work described herein for the following unit prices or lump sum amounts.

- Note:*
1. Bids shall include sales tax and all other applicable taxes and fees.
 2. All bids shall be checked for errors. If errors are made, unit prices shall govern and corrections will be made according to the unit price and totals will be revised to reflect the corrections.
 3. Approved Equals must have written approval from the Engineer prior to the Bid Opening to be used in bids.

No.	Reference	Item	Quantity	Unit	Unit Price	Amount
Base Bid Items						
1	01019.2SP	Mobilization	1	LS		
2	01019.3SP	Preconstruction DVD	1	LS		
3	01019.4SP	Traffic Control & Site Security	1	LS		
4	01019.5SP	Temporary Construction Access	1	LS		
5	01019.6SP	Biosecurity Plan Implementation	1	LS		
6	01019.7SP	Clearing, Grubbing, & Demolition	1	LS		
7	01019.8SP	Spring Exploration & Development	80	HR		
8	01019.9SP	Spring Collection Box	1	LS		
9	01019.10SP	Spring Collection Manhole	1	LS		
10	01019.11SP	14" C905 DR18 PVC Perforated Collection Pipe	30	LF		
11	01019.12SP	12" C900 DR18 PVC Transmission Pipe	133	LF		
12	01019.13SP	24" C905 DR18 PVC Perforated Collection Pipe	219	LF		
13	01019.14SP	18" C905 DR18 PVC Transmission Pipe	109	LF		
14	01019.15SP	40 mil Polyethylene Liner	498	SY		
15	01019.16SP	1" Drain Gravel	277	CY		
16	01019.17SP	Clay Cutoff Wall	11	CY		
17	01019.18SP	Miscellaneous Valves, Fittings, & Connections	1	LS		
18	01019.19SP	Site Cleanup & Grading	1	LS		
19	01019.20SP	Reseeding	1	LS		
20	01019.21SP	Hatchery Core w/ Tie-In	1	LS		
					<i>Subtotal</i>	
Add Alternate Bid Items						
21	01019.22SP	Install 18" C905 DR18 Bypass Line	1,050	LF		
22	01019.23SP	Turbulent Fountain	1	LS		
23	01019.24SP	Remove, Dispose, & Fill Existing Raceways	335	SY		
					<i>Subtotal</i>	

TOTAL



INSTRUCTIONS AND SUBCONTRACTORS LIST FORM

The three low bidders, as well as all other bidders that desire to be considered, are required by law to submit to DFCM within 24 hours of bid opening a list of **ALL** first-tier subcontractors, including the subcontractor's name, bid amount and other information required by Building Board Rule and as stated in these Contract Documents, based on the following:

DOLLAR AMOUNTS FOR LISTING

PROJECTS UNDER \$500,000: ALL FIRST-TIER SUBS \$20,000 OR OVER MUST BE LISTED
PROJECTS \$500,000 OR MORE: ALL FIRST-TIER SUBS \$35,000 OR OVER MUST BE LISTED

- Any additional subcontractors identified in the bid documents shall also be listed.
- The DFCM Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law.
- List subcontractors for base bid as well as the impact on the list that the selection of any alternate may have.
- Bidder may not list more than one subcontractor to perform the same work.
- If there are no subcontractors for the job that are required to be reported by State law (either because there are no subcontractors that will be used on the project or because there are no first-tier subcontractors over the dollar amounts referred to above), then you do not need to submit a sublist. If you do not submit a sublist, it will be deemed to be a representation by you that there are no subcontractors on the job that are required to be reported under State law. At any time, DFCM reserves the right to inquire, for security purposes, as to the identification of the subcontractors at any tier that will be on the worksite.

LICENSURE:

The subcontractor's name, the type of work, the subcontractor's bid amount, and the subcontractor's license number as issued by DOPL, if such license is required under Utah Law, shall be listed. Bidder shall certify that all subcontractors, required to be licensed, are licensed as required by State law. A subcontractor includes a trade contractor or specialty contractor and does not include suppliers who provide only materials, equipment, or supplies to a contractor or subcontractor.

'SPECIAL EXCEPTION':

A bidder may list 'Special Exception' in place of a subcontractor when the bidder intends to obtain a subcontractor to perform the work at a later date because the bidder was unable to obtain a qualified or reasonable bid under the provisions of U.C.A. Section 63A-5-208(4). The bidder shall insert the term 'Special Exception' for that category of work, and shall provide documentation with the subcontractor list describing the bidder's efforts to obtain a bid of a qualified subcontractor at a reasonable cost and why the bidder was unable to obtain a qualified subcontractor bid. The Director must find that the bidder complied in good faith with State law requirements for any 'Special Exception' designation, in order for the bid to be considered. If awarded the contract, the Director shall supervise the bidder's efforts to obtain a qualified subcontractor bid. The amount of the awarded contract may not be adjusted to reflect the actual amount of the subcontractor's bid. Any listing of 'Special Exception' on the sublist form shall also include amount allocated for that work.

GROUND FOR DISQUALIFICATION:

The Director may not consider any bid submitted by a bidder if the bidder fails to submit a subcontractor list meeting the requirements of State law. Director may withhold awarding the contract to a particular bidder if one or more of the proposed subcontractors are considered by the Director to be unqualified to do the Work or for

INSTRUCTIONS AND SUBCONTRACTORS LIST FORM
PAGE NO. 2

such other reason in the best interest of the State of Utah. Notwithstanding any other provision in these instructions, if there is a good faith error on the sublist form, at the sole discretion of the Director, the Director may provide notice to the contractor and the contractor shall have 24 hours to submit the correction to the Director. If such correction is submitted timely, then the sublist requirements shall be considered met.

CHANGES OF SUBCONTRACTORS SPECIFICALLY IDENTIFIED ON SUBLIST FORM:

Subsequent to twenty-four hours after the bid opening, the contractor may change its listed subcontractors only after receiving written permission from the Director based on complying with all of the following criteria.

- (1) The contractor has established in writing that the change is in the best interest of the State and that the contractor establishes an appropriate reason for the change, which may include, but not is not limited to, the following reasons: the original subcontractor has failed to perform, or is not qualified or capable of performing, and/or the subcontractor has requested in writing to be released.
- (2) The circumstances related to the request for the change do not indicate any bad faith in the original listing of the subcontractors.
- (3) Any requirement set forth by the Director to ensure that the process used to select a new subcontractor does not give rise to bid shopping.
- (4) Any increase in the cost of the subject subcontractor work is borne by the contractor.
- (5) Any decrease in the cost of the subject subcontractor work shall result in a deductive change order being issued for the contract for such decreased amount.
- (6) The Director will give substantial weight to whether the subcontractor has consented in writing to being removed unless the Contractor establishes that the subcontractor is not qualified for the work.

EXAMPLE:

Example of a list where there are only four subcontractors:

TYPE OF WORK	SUBCONTRACTOR, "SELF" OR "SPECIAL EXCEPTION"	SUBCONTRACTOR BID AMOUNT	CONTRACTOR LICENSE #
ELECTRICAL	ABCD Electric Inc.	\$350,000.00	123456789000
LANDSCAPING	"Self" *	\$300,000.00	123456789000
CONCRETE (ALTERNATE #1)	XYZ Concrete Inc	\$298,000.00	987654321000
MECHANICAL	"Special Exception" (attach documentation)	Fixed at: \$350,000.00	(TO BE PROVIDED AFTER OBTAINING SUBCONTRACTOR)

* Bidders may list "self", but it is not required.

PURSUANT TO STATE LAW - SUBCONTRACTOR BID AMOUNTS CONTAINED IN THIS SUBCONTRACTOR LIST SHALL NOT BE DISCLOSED UNTIL THE CONTRACT HAS BEEN AWARDED.



SUBCONTRACTORS LIST
FAX TO 801-538-3677

PROJECT TITLE: _____

Caution: You must read and comply fully with instructions.

Table with 4 columns: TYPE OF WORK, SUBCONTRACTOR, 'SELF' OR 'SPECIAL EXCEPTION', SUBCONTRACTOR BID AMOUNT, CONT. LICENSE #

We certify that:

- 1. This list includes all subcontractors as required by the instructions, including those related to the base bid as well as any alternates.
2. We have listed 'Self' or 'Special Exception' in accordance with the instructions.
3. All subcontractors are appropriately licensed as required by State law.

FIRM: _____

DATE: _____

SIGNED BY: _____

NOTICE: FAILURE TO SUBMIT THIS FORM, PROPERLY COMPLETED AND SIGNED, AS REQUIRED IN THESE CONTRACT DOCUMENTS, SHALL BE GROUNDS FOR OWNER'S REFUSAL TO ENTER INTO A WRITTEN CONTRACT WITH BIDDER. ACTION MAY BE TAKEN AGAINST BIDDERS BID BOND AS DEEMED APPROPRIATE BY OWNER. ATTACH A SECOND PAGE IF NECESSARY.

CONTRACTOR'S AGREEMENT

FOR:

THIS CONTRACTOR'S AGREEMENT, made and entered into this __ day of _____, 2006, by and between the DIVISION OF FACILITIES CONSTRUCTION AND MANAGEMENT, hereinafter referred to as "DFCM", and _____, incorporated in the State of Utah and authorized to do business in the State of Utah, hereinafter referred to as "Contractor", whose address is _____ Utah _____.

WITNESSETH: WHEREAS, DFCM intends to have _____ Work performed at _____

WHEREAS, Contractor agrees to perform the Work for the sum stated herein.

NOW, THEREFORE, DFCM and Contractor for the consideration provided in this Contractor's Agreement, agree as follows:

ARTICLE 1. SCOPE OF WORK. The Work to be performed shall be in accordance with the Contract Documents prepared by _____ and entitled "_____."

The DFCM General Conditions ("General Conditions") dated May 25, 2005 and all Supplemental General Conditions ("also referred to as General Conditions") on file at the office of DFCM and available on the DFCM website (<http://dfcm.utah.gov/StdDocs/index.html>), are hereby incorporated by reference as part of this Agreement and are included in the specifications for this Project. All terms used in this Contractor's Agreement shall be as defined in the Contract Documents, and in particular, the General Conditions.

The Contractor Agrees to furnish labor, materials and equipment to complete the Work as required in the Contract Documents which are hereby incorporated by reference. It is understood and agreed by the parties hereto that all Work shall be performed as required in the Contract Documents and shall be subject to inspection and approval of DFCM or its authorized representative. The relationship of the Contractor to the DFCM hereunder is that of an independent Contractor.

ARTICLE 2. CONTRACT SUM. The DFCM agrees to pay and the Contractor agrees to accept in full performance of this Contractor's Agreement, the sum of _____ **DOLLARS AND NO CENTS** (\$ _____), which is the base bid, and includes the cost of a 100%

CONTRACTOR'S AGREEMENT
PAGE NO. 2

Performance Bond and a 100% Payment Bond as well as all insurance requirements of the Contractor. Said bonds have already been posted by the Contractor pursuant to State law. The required proof of insurance certificates have been delivered to DFCM in accordance with the General Conditions before the execution of this Contractor's Agreement.

ARTICLE 3. TIME OF COMPLETION AND DELAY REMEDY. The Work shall be Substantially Complete by _____ after the date of the Notice to Proceed. Contractor agrees to pay liquidated damages in the amount of _____ per day for each day after expiration of the Contract Time until the Contractor achieves Substantial Completion in accordance with the Contract Documents, if Contractor's delay makes the damages applicable. The provision for liquidated damages is: (a) to compensate the DFCM for delay only; (b) is provided for herein because actual damages can not be readily ascertained at the time of execution of this Contractor's Agreement; (c) is not a penalty; and (d) shall not prevent the DFCM from maintaining Claims for other non-delay damages, such as costs to complete or remedy defective Work.

No action shall be maintained by the Contractor, including its or Subcontractor or suppliers at any tier, against the DFCM or State of Utah for damages or other claims due to losses attributable to hindrances or delays from any cause whatsoever, including acts and omissions of the DFCM or its officers, employees or agents, except as expressly provided in the General Conditions. The Contractor may receive a written extension of time, signed by the DFCM, in which to complete the Work under this Contractor's Agreement in accordance with the General Conditions.

ARTICLE 4. CONTRACT DOCUMENTS. The Contract Documents consist of this Contractor's Agreement, the Conditions of the Contract (DFCM General Conditions, Supplementary and other Conditions), the Drawings, Specifications, Addenda and Modifications. The Contract Documents shall also include the bidding documents, including the Notice to Contractors, Instructions to Bidders/Proposers and the Bid/Proposal, to the extent not in conflict therewith and other documents and oral presentations that are documented as an attachment to the contract.

All such documents are hereby incorporated by reference herein. Any reference in this Contractor's Agreement to certain provisions of the Contract Documents shall in no way be construed as to lessen the importance or applicability of any other provisions of the Contract Documents.

ARTICLE 5. PAYMENT. The DFCM agrees to pay the Contractor from time to time as the Work progresses, but not more than once each month after the date of Notice to Proceed, and only upon Certificate of the A/E for Work performed during the preceding calendar month, ninety-five percent (95%) of the value of the labor performed and ninety-five percent (95%) of the value of materials furnished in place or on the site. The Contractor agrees to furnish to the DFCM invoices for materials purchased and on the site but not installed, for which the

CONTRACTOR'S AGREEMENT
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Contractor requests payment and agrees to safeguard and protect such equipment or materials and is responsible for safekeeping thereof and if such be stolen, lost or destroyed, to replace same.

Such evidence of labor performed and materials furnished as the DFCM may reasonably require shall be supplied by the Contractor at the time of request for Certificate of Payment on account. Materials for which payment has been made cannot be removed from the job site without DFCM's written approval. Five percent (5%) of the earned amount shall be retained from each monthly payment. The retainage, including any additional retainage imposed and the release of any retainage, shall be in accordance with UCA 13-8-5 as amended. Contractor shall also comply with the requirements of UCA 13-8-5, including restrictions of retainage regarding subcontractors and the distribution of interest earned on the retention proceeds. The DFCM shall not be responsible for enforcing the Contractor's obligations under State law in fulfilling the retention law requirements with subcontractors at any tier.

ARTICLE 6. INDEBTEDNESS. Before final payment is made, the Contractor must submit evidence satisfactory to the DFCM that all payrolls, materials bills, subcontracts at any tier and outstanding indebtedness in connection with the Work have been properly paid. Final Payment will be made after receipt of said evidence, final acceptance of the Work by the DFCM as well as compliance with the applicable provisions of the General Conditions.

Contractor shall respond immediately to any inquiry in writing by DFCM as to any concern of financial responsibility and DFCM reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third parties prior to any payment by DFCM to Contractor.

ARTICLE 7. ADDITIONAL WORK. It is understood and agreed by the parties hereto that no money will be paid to the Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. The DFCM specifically reserves the right to modify or amend this Contractor's Agreement and the total sum due hereunder either by enlarging or restricting the scope of the Work.

ARTICLE 8. INSPECTIONS. The Work shall be inspected for acceptance in accordance with the General Conditions.

ARTICLE 9. DISPUTES. Any dispute, PRE or Claim between the parties shall be subject to the provisions of Article 7 of the General Conditions. DFCM reserves all rights to pursue its rights and remedies as provided in the General Conditions.

ARTICLE 10. TERMINATION, SUSPENSION OR ABANDONMENT. This Contractor's Agreement may be terminated, suspended or abandoned in accordance with the General Conditions.

ARTICLE 11. DFCM'S RIGHT TO WITHHOLD CERTAIN AMOUNT AND MAKE USE THEREOF. The DFCM may withhold from payment to the Contractor such amount as, in DFCM's judgment, may be necessary to pay just claims against the Contractor or Subcontractor at any tier for labor and services rendered and materials furnished in and about the Work. The DFCM may apply such withheld amounts for the payment of such claims in DFCM's discretion. In so doing, the DFCM shall be deemed the agent of Contractor and payment so made by the DFCM shall be considered as payment made under this Contractor's Agreement by the DFCM to the Contractor. DFCM shall not be liable to the Contractor for any such payment made in good faith. Such withholdings and payments may be made without prior approval of the Contractor and may be also be prior to any determination as a result of any dispute, PRE, Claim or litigation.

ARTICLE 12. INDEMNIFICATION. The Contractor shall comply with the indemnification provisions of the General Conditions.

ARTICLE 13. SUCCESSORS AND ASSIGNMENT OF CONTRACT. The DFCM and Contractor, respectively bind themselves, their partners, successors, assigns and legal representatives to the other party to this Agreement, and to partners, successors, assigns and legal representatives of such other party with respect to all covenants, provisions, rights and responsibilities of this Contractor's Agreement. The Contractor shall not assign this Contractor's Agreement without the prior written consent of the DFCM, nor shall the Contractor assign any moneys due or to become due as well as any rights under this Contractor's Agreement, without prior written consent of the DFCM.

ARTICLE 14. RELATIONSHIP OF THE PARTIES. The Contractor accepts the relationship of trust and confidence established by this Contractor's Agreement and covenants with the DFCM to cooperate with the DFCM and A/E and use the Contractor's best skill, efforts and judgment in furthering the interest of the DFCM; to furnish efficient business administration and supervision; to make best efforts to furnish at all times an adequate supply of workers and materials; and to perform the Work in the best and most expeditious and economic manner consistent with the interests of the DFCM.

ARTICLE 15. AUTHORITY TO EXECUTE AND PERFORM AGREEMENT. Contractor and DFCM each represent that the execution of this Contractor's Agreement and the performance thereunder is within their respective duly authorized powers.

ARTICLE 16. ATTORNEY FEES AND COSTS. Except as otherwise provided in the dispute resolution provisions of the General Conditions, the prevailing party shall be entitled to reasonable attorney fees and costs incurred in any action in the District Court and/or appellate body to enforce this Contractor's Agreement or recover damages or any other action as a result of a breach thereof.

PERFORMANCE BOND
(Title 63, Chapter 56, U. C. A. 1953, as Amended)

That _____ hereinafter referred to as the "Principal" and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____ and authorized to transact business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah, hereinafter referred to as the "Obligee," in the amount of _____ DOLLARS (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____, for the approximate sum of _____ Dollars (\$ _____), which Contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall faithfully perform the Contract in accordance with the Contract Documents including, but not limited to, the Plans, Specifications and conditions thereof, the one year performance warranty, and the terms of the Contract as said Contract may be subject to Modifications or changes, then this obligation shall be void; otherwise it shall remain in full force and effect.

No right of action shall accrue on this bond to or for the use of any person or corporation other than the state named herein or the heirs, executors, administrators or successors of the Owner.

The parties agree that the dispute provisions provided in the Contract Documents apply and shall constitute the sole dispute procedures of the parties.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the Provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

PRINCIPAL:

By: _____

(Seal)

Title: _____

WITNESS OR ATTESTATION:

SURETY:

By: _____
Attorney-in-Fact

(Seal)

STATE OF _____)
) ss.
COUNTY OF _____)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney in-fact of the above-named Surety Company and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.
My commission expires: _____
Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

PAYMENT BOND

(Title 63, Chapter 56, U. C. A. 1953, as Amended)

KNOW ALL PERSONS BY THESE PRESENTS:

That _____ hereinafter referred to as the "Principal," and _____, a corporation organized and existing under the laws of the State of _____ authorized to do business in this State and U. S. Department of the Treasury Listed (Circular 570, Companies Holding Certificates of Authority as Acceptable Securities on Federal Bonds and as Acceptable Reinsuring Companies); with its principal office in the City of _____, hereinafter referred to as the "Surety," are held and firmly bound unto the State of Utah hereinafter referred to as the "Obligee," in the amount of _____ Dollars (\$ _____) for the payment whereof, the said Principal and Surety bind themselves and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the _____ day of _____, 20____, to construct _____ in the County of _____, State of Utah, Project No. _____ for the approximate sum of _____ Dollars (\$ _____), which contract is hereby incorporated by reference herein.

NOW, THEREFORE, the condition of this obligation is such that if the said Principal shall pay all claimants supplying labor or materials to Principal or Principal's Subcontractors in compliance with the provisions of Title 63, Chapter 56, of Utah Code Annotated, 1953, as amended, and in the prosecution of the Work provided for in said Contract, then, this obligation shall be void; otherwise it shall remain in full force and effect.

That said Surety to this Bond, for value received, hereby stipulates and agrees that no changes, extensions of time, alterations or additions to the terms of the Contract or to the Work to be performed thereunder, or the specifications or drawings accompanying same shall in any way affect its obligation on this Bond, and does hereby waive notice of any such changes, extensions of time, alterations or additions to the terms of the Contract or to the Work or to the specifications or drawings and agrees that they shall become part of the Contract Documents.

PROVIDED, HOWEVER, that this Bond is executed pursuant to the provisions of Title 63, Chapter 56, Utah Code Annotated, 1953, as amended, and all liabilities on this Bond shall be determined in accordance with said provisions to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this instrument this _____ day of _____, 20____.

WITNESS OR ATTESTATION:

(Seal)

WITNESS OR ATTESTATION:

STATE OF _____)
) ss.
COUNTY OF _____)

PRINCIPAL:

By: _____

Title: _____

SURETY:

By: _____
Attorney-in-Fact (Seal)

On this _____ day of _____, 20____, personally appeared before me _____, whose identity is personally known to me or proved to me on the basis of satisfactory evidence, and who, being by me duly sworn, did say that he/she is the Attorney-in-fact of the above-named Surety Company, and that he/she is duly authorized to execute the same and has complied in all respects with the laws of Utah in reference to becoming sole surety upon bonds, undertakings and obligations, and that he/she acknowledged to me that as Attorney-in-fact executed the same.

Subscribed and sworn to before me this _____ day of _____, 20____.
My commission expires: _____
Resides at: _____

NOTARY PUBLIC

Agency: _____
Agent: _____
Address: _____
Phone: _____

Approved As To Form: May 25, 2005
By Alan S. Bachman, Asst Attorney General

BIDDING DOCUMENTS & SPECIFICATIONS

for

UTAH DFCM & UTAH DWR

Loa Fish Hatchery Spring Redevelopment

DFCM Project #10050520



**Prepared by:
SUNRISE ENGINEERING, INC.
2390 West Highway 56, Suite 6
Cedar City, Utah 84720
Ph: (435) 867-8834
Fax: (435) 652-8416**

BIDDING DOCUMENTS & SPECIFICATIONS

for

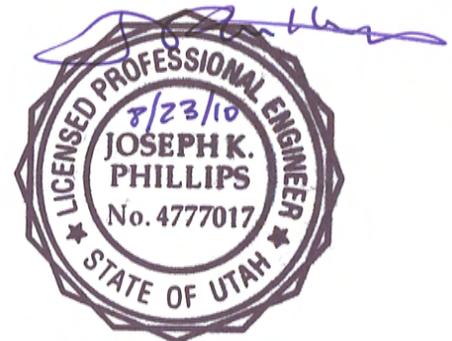
UTAH DFCM & UTAH DWR Loa Fish Hatchery Spring Redevelopment

DFCM Project #10050520

PREPARED BY:



2390 West Highway 56, Suite 6
Cedar City, Utah 84720
Tel: (435) 867-8834
Fax: (435) 652-8416



Joseph K. Phillips, P.E.
State of Utah No. 4777017
Project Engineer
Date: August 23, 2010

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For
UTAH DFCM & UTAH DWR
Loa Fish Hatchery Spring Redevelopment
DFCM Project #10050520**

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BID SCHEDULE



LOA FISH HATCHERY SPRING REDEVELOPMENT BID SCHEDULE

CONTRACT FOR: Utah DFCM & Utah DWR, Loa Fish Hatchery Spring Redevelopment

The undersigned Bidder, having examined and determined the scope of the Contract Documents, hereby proposes to perform the work described herein for the following unit prices or lump sum amounts.

- Note: 1. Bids shall include sales tax and all other applicable taxes and fees.
 2. All bids shall be checked for errors. If errors are made, unit prices shall govern and corrections will be made according to the unit price and totals will be revised to reflect the corrections.
 3. Approved Equals must have written approval from the Engineer prior to the Bid Opening to be used in bids.*

No.	Reference	Item	Quantity	Unit	Unit Price	Amount
Base Bid Items						
1	01019.2SP	Mobilization	1	LS		
2	01019.3SP	Preconstruction DVD	1	LS		
3	01019.4SP	Traffic Control & Site Security	1	LS		
4	01019.5SP	Temporary Construction Access	1	LS		
5	01019.6SP	Biosecurity Plan Implementation	1	LS		
6	01019.7SP	Clearing, Grubbing, & Demolition	1	LS		
7	01019.8SP	Spring Exploration & Development	80	HR		
8	01019.9SP	Spring Collection Box	1	LS		
9	01019.10SP	Spring Collection Manhole	1	LS		
10	01019.11SP	14" C905 DR18 PVC Perforated Collection Pipe	30	LF		
11	01019.12SP	12" C900 DR18 PVC Transmission Pipe	133	LF		
12	01019.13SP	24" C905 DR18 PVC Perforated Collection Pipe	219	LF		
13	01019.14SP	18" C905 DR18 PVC Transmission Pipe	109	LF		
14	01019.15SP	40 mil Polyethylene Liner	498	SY		
15	01019.16SP	1" Drain Gravel	277	CY		
16	01019.17SP	Clay Cutoff Wall	11	CY		
17	01019.18SP	Miscellaneous Valves, Fittings, & Connections	1	LS		
18	01019.19SP	Site Cleanup & Grading	1	LS		
19	01019.20SP	Reseeding	1	LS		
20	01019.21SP	Hatchery Core w/ Tie-In	1	LS		
					<i>Subtotal</i>	
Add Alternate Bid Items						
21	01019.22SP	Install 18" C905 DR18 Bypass Line	1,050	LF		
22	01019.23SP	Turbulent Fountain	1	LS		
23	01019.24SP	Remove, Dispose, & Fill Existing Raceways	335	SY		
					<i>Subtotal</i>	

TOTAL

The undersigned Bidder certifies that this proposal is made in good faith, without collusion or connection with any other person or persons bidding on the work.

Seal (if bid is by Corporation)

Respectfully Submitted:

Bidder: _____

Signature _____

License No. _____

Title: _____

Date: _____

Address: _____

01019.1 DESCRIPTION

This Section covers measurement and payment practices utilized by Sunrise Engineering in performing its contract management services according to the requirements of these Specifications and other parts of the Contract Documents.

01019.2 MEASUREMENT**01019.2.1 METHODS**

The method of measurement and computations to be used in determination of quantities of material furnished, and of work performed under the Contract, will be those methods generally recognized as conforming to good engineering practice.

When items of improvement, equipment, or service referred to herein as "work" are shown on the plans and/or called for in the specifications for the CONTRACTOR to furnish, install, or provide, the items of work shall be measured and paid for in one of two ways. First, if the item of work is considered incidental to other items in the Bid Schedule, no separate measurement and payment shall be made and no separate bid item in the bid schedule will appear. In this case measurement and payment for this work shall be included by the CONTRACTOR in other bid items on the bid schedule. Second, when shown separately on the bid schedule, the item of work shall be measured as called for in the specifications and paid for at the contract unit price for that work.

01019.2.2 ACCURATE PRICING

The Bidder shall include a price for all bid items in the Bid Schedule and the Schedule of Values if required. Failure to do so may render the Bid non-responsive and may cause its rejection. All bids will be checked for errors. In the event the total "amount" indicated on the Bid schedule for a bid item does not equal the product of the unit price times the estimated quantity, the unit price shall govern, and the amount will be corrected accordingly. In the event the Bid Total does not agree with the sum of the prices bid on the individual bid items, the individual item prices shall govern and the total for the Bid schedule will be corrected accordingly. The CONTRACTOR shall be bound by any such corrections. For "Lump Sum" bid items, where applicable, the total shown on the Schedule of Values shall equal the amount entered for the corresponding bid item on the Bid schedule.

01019.2.3 U.S. STANDARD MEASURE

All work completed under this Contract will be measured by U.S. standard measure for the units described herein. Work performed by the CONTRACTOR will be measured in those units in accordance with the procedure described herein.

01019.2.4 MEASUREMENT BY ENGINEER

Since the quantities appearing on the Bid Schedules are approximate only and are prepared for the comparison of bids, all work and materials are subject to measurement by the ENGINEER. Measurement of work performed by the CONTRACTOR on Bid items with unit prices other than "lump sum" will be for the actual quantities of work performed and accepted, or material furnished in accordance with the Contract. In the case of lump sum bid items, the ENGINEER will verify that all of the work represented by the bid item has been completed.

01019.2.5 VARIATIONS IN QUANTITIES OF WORK

The scheduled quantities of work to be done and materials to be furnished may each be increased, decreased, or omitted at the OWNER's discretion.

01019.2.6 MEASUREMENT BY LUMP SUM

The term "Lump Sum" when used as a unit of measurement for a specific improvement or separate component of a unit shall include all work necessary to complete that entire unit, including all necessary fittings and accessories delineated by the pay limits as shown on the Drawings. If no pay limits are shown on the Drawings, then the improvement shall include all fittings and accessories within 5-feet of the item.

01019.2.7 MEASUREMENT BY LINEAL FOOT

All work measured by the lineal foot shall be measured parallel to the centerline. For water and gas piping, no deduction will be made for valve, fittings or carrier pipe. For sewer collection piping, measurement shall be to the inside surface of connecting manholes. Piping connected to structures, except headwalls, shall be measured to a point five (5) feet outside of that structure, unless indicated otherwise on the Drawings.

A station, when used as a unit of measurement, will be 100 lineal feet.

Items measured by the lineal foot; such as pipe culverts, guardrail, under-drains, etc., will be measured parallel to the base or foundations upon which structures are placed.

The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing will be specified and measured in decimal fractions of inches.

01019.2.8 MEASUREMENT BY AREA

Area computations will be made from actual horizontal and transverse measurements made on the site of the work.

Structures will be measured to the neat lines shown on the plans or as altered to fit site conditions.

Lumber will be measured by the thousand feet board measure (M.F.B.M.) actually incorporated in the structure. Measurement will be based on nominal widths and thickness and the extreme length of each piece.

01019.2.9 MEASUREMENT BY VOLUME

In computing volumes of excavation, the average end area method will be used unless the ENGINEER and CONTRACTOR agree, in writing, to an alternate method.

Materials to be measured by volume or by load count shall be hauled in approved vehicles and measured at the point of delivery. Vehicles for this purpose may be of any size or type, provided the body is shaped so the actual volume may be readily and accurately determined.

When liquid bituminous materials are measured by the gallon or ton, volumes will be measured at 60° F, or will be corrected to the volume of 60 degrees F, using ASTM D 1250 for asphalt or ASTM D 633 for tars. When bituminous materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming, may be used for computing quantities.

01019.2.10 MEASUREMENT BY WEIGHT

The term "ton" will mean the short ton of 2,000 pounds avoirdupois.

When measurement units require weighing materials for payment, the CONTRACTOR shall be responsible for providing weight measurement from commercial certified scales or from scales provided at the job site which are certified in the state wherein the work is located.

Cement will be measured by the ton or hundredweight.

01019.2.11 CONVERSION OF WEIGHT TO VOLUME

When requested by the CONTRACTOR and approved by the ENGINEER in writing, materials specified to be measured by the cubic yard may first be weighed and the weight converted to cubic yards for payment purposes. Factors for conversion from weight measurement to volume measurement will be determined by the ENGINEER and agreed to by the CONTRACTOR before this method of measurement of quantities is used.

01019.2.12 SPECIFIC MANUFACTURED ITEMS

When standard manufactured items are specified such as fence, wire, plates, rolled shapes, pipe conduit, etc., and these items are identified by gauge, unit, weight, section dimensions, etc., such identification will be considered to be nominal weights or dimensions. Unless more stringently controlled by tolerance in cited specifications, manufacturing tolerances established by the industries involved will be accepted.

01019.2.13 RENTAL EQUIPMENT

Rental of equipment will be measured in hours of actual working time and necessary traveling time of the equipment within the limits of the project. If equipment is ordered held on the project on a standby basis by the ENGINEER, the agreed rental rate, minus the labor and fuel costs, will be paid.

01019.2.14 MEASUREMENT BY EACH

All work measured by each shall be an individual or single unit.

01019.3 PAYMENT

01019.3.1 SCOPE OF PAYMENT

The CONTRACTOR shall receive and accept compensation provided in the Contract as full payment for:

- Furnishing all materials, labor, equipment, tools, transportation and incidentals required for completion of work.
- All loss or damage due to the nature of the work, action of the elements and unforeseen difficulties until final acceptance by the ENGINEER, subject to the provisions of the General Conditions.
- All costs arising from any infringement of a patent, trademark or copyright.
- Bids shall include all sales tax and all other applicable fees.

01019.3.2 NON-PAYMENT

No payment will be made for:

- Work which is in excess of that described in the Contract Documents.

- Removal and replacement of defective work.
- Loss of anticipated profits.

01019.3.3 LUMP SUM

The term "lump sum", when used as a unit for payment, shall include all work required to complete the item, including all necessary fittings and accessories, as described in the Bid Schedule.

01019.3.4 FULL PAYMENT

The CONTRACTOR shall receive and accept compensation provided for in the Contract as full payment for furnishing all materials and for performing all work under the Contract in a complete and acceptable manner and for all risk, loss, damage or expense of whatever character arising out of the nature of the work or the execution thereof.

01019.3.5 VARIATION IN QUANTITY OF WORK

The OWNER reserves the right to make variations in quantities by adding to, or deleting from, quantities listed in the bid schedule in order to match the total bid with the money available in the budget.

01019.1 INTRODUCTION

This section seeks to more clearly identify those tasks which are specifically included in each of the respective Bid Schedule items and thereby minimize confusion that sometimes arises with regard to measurement of and payment for specific tasks comprising the Work. Inclusion or exclusion of any item or task from this Section shall in no way be construed to mean that additional payment shall be required of the OWNER. All materials, equipment, expenses, operations and labor necessary to complete the Work in the manner intended by the Drawings and Contract Documents and Specifications not specifically listed as a line item in the Bid Schedule or described in the following subsections shall be considered incidental to the Work and shall not cause the Contractor to be eligible for additional payment by the OWNER. **All bid items shall be considered as deductible alternate bid items. The OWNER reserves the right to deduct any items as required to meet budget constraints.**

01019.2 BID ITEM “MOBILIZATION”

This bid item shall be paid for by the lump sum and shall include but is not limited to all preparatory work, materials necessary for obtaining clearances for the Work, moving personnel, equipment, supplies and incidentals to the Project Site, providing materials receipt, inspection, and protection efforts, quality control, clean-up, temporary utilities and quarters, permits, bonds, insurance, storm water control, noise abatement, waste, rubbish disposal and control, sanitation, project close-out operations, etc. The lump sum unit price for mobilization shall not exceed 10% of the total bid.

01019.3 BID ITEM “PRECONSTRUCTION DVD”

This bid item shall be paid for by the lump sum and shall include all material, labor, operations and equipment necessary to complete the pre-project video to the requirements of the Specifications. Video shall be produced for all areas that have the potential to be disturbed by the Contractor. Two copies of the video shall be provided on DVDs before construction shall be allowed to proceed. VHS or other formats will not be accepted. Construction shall not begin until the video has been approved by the ENGINEER.

01019.4 BID ITEM “TRAFFIC CONTROL & SITE SECURITY”

This bid item shall be paid for by the lump sum and shall include all material, labor, operations and equipment necessary to provide traffic control in accordance with MUTCD and AASHTO standards and with the OWNER’s and/or ENGINEER’s direction for the duration of the Project. This bid item shall also include all material, labor, operations and equipment necessary to provide the proper site security and safety measures, and includes temporary security/safety fences or other measures as needed or as Coordinated with the OWNER or ENGINEER. Partial payment shall be made based on the overall percentage of the Project that is paid for at each payment request.

01019.5 BID ITEM “TEMPORARY CONSTRUCTION ACCESS”

This bid item shall be paid for by the lump sum and shall include all materials, labor, operations and equipment necessary to provide temporary construction access in accordance with the Drawings and Project Specifications. The CONTRACTOR shall prepare temporary construction access through the southwest corner of the existing perimeter fence. The specific approach to construction access shall be left to the discretion of the CONTRACTOR. However, all surface and underground improvements, including fencing elements, concrete structures, landscaping and irrigation, street improvements, etc. shall be repaired, replaced, and otherwise returned to original or better conditions at the conclusion of construction.

01019.6 BID ITEM “BIOSECURITY PLAN IMPLEMENTATION”

This bid item shall be paid for by the lump sum and shall include all materials, labor, operations, and equipment necessary to implement the biosecurity plan and shall include but is not limited to proper disinfection, power washing, dry time, chlorine bleach, and proper removal of loose debris and dirt prior to arrival as indicated in the Drawings.

01019.7 BID ITEM “CLEARING, GRUBBING, & DEMOLITION”

This bid item shall be paid for by the lump sum and shall include the removal and disposal of any vegetation, debris, or other obstacles from the project area and/or construction work site. This item shall also include all material, cost, labor and equipment necessary for the removal and disposal of any existing features not already planned to be removed by the OWNER as shown on the Demolition Plan, sheet DP1. This item includes existing features, including but not limited to, waterlines, concrete structures, and the disposal of resulting waste materials and debris. The CONTRACTOR shall ensure that all materials are legally disposed of.

01019.8 BID ITEM “SPRING EXPLORATION & DEVELOPMENT”

This item shall be paid for by the hourly rate provided in the bid schedule and to the extents coordinated with the ENGINEER. As explained in Section 13810SP, the intent of the Work is to expose the water bearing strata within the designated area of the spring and to capture all of the water produced by those strata. Because of the variations which can take place in geologic formations, unknown conditions may occur which require deviation from the construction concept presented in the Drawings. This item shall include any necessary work to locate and expose the water bearing strata and prepare it for the refurbishment that will be performed with the other bid items.

01019.9 BID ITEMS “SPRING COLLECTION BOX”

This item shall be paid for by the lump sum and shall include all labor, materials, equipment, etc. necessary to construct and install the spring collection box as intended by the Drawings. This includes but is not limited to the cost of the lid, concrete pad, steel, sealant, untreated base course, rubber boots, gravel backfill, galvanizing, weir plates, hatch, etc. This item shall also include any pipe, fittings, valves, equipment, materials, overflow/bypass stub out, and labor to construct and connect pipes meant to carry the water out of the box as shown on the Drawings. This item shall not apply to portion of the cost for that part of the pipe meant to carry water into or out of the box, if the pipe is beyond the outside edge of the collection box.

01019.10 BID ITEM “SPRING COLLECTION MANHOLE”

This item shall be paid for by the lump sum and shall include all materials, equipment, expenses, time, labor, etc. necessary to install the collection manhole as intended by the Drawings. This includes but is not limited to the cost of the manhole frame and lid, concrete pad, grade rings, pre-cast cones and base sections, steps, steel, sealant, untreated base course, rubber boot, gravel backfill, stub outs where required, hatch, etc. This item shall not apply to pipe meant to carry water into or out of the manhole, if the pipe is beyond the outside edge of the pre-cast collection manhole.

01019.11 BID ITEM “14-INCH C905 DR18 PVC PERFORATED COLLECTION PIPE”

See Section 02222.4 for Method of Measurement. Payment shall be made by the lineal foot of PVC pipe installed and shall also include all pipe, fittings, onsite and import pipe bedding, backfill, etc., as required by the Drawings and Specifications. This item shall include all subsurface exploration, pipe, connections, and fittings not specifically included in other bid items. (See Section 02222 & 02200)

01019.12 BID ITEMS “12-INCH C900 DR18 PVC TRANSMISSION PIPE”

See Section 02222.4 for Method of Measurement. Payment shall be made by the lineal foot of PVC pipe installed and shall also include all pipe, fittings, onsite and import pipe bedding, backfill, etc., as required by the Drawings and Specifications. This item shall include all subsurface exploration, pipe, connections, and fittings not specifically included in other bid items. (See Section 02222 & 02200)

01019.13 BID ITEM “24-INCH C905 DR18 PVC PERFORATED COLLECTION PIPE”

See Section 02222.4 for Method of Measurement. Payment shall be made by the lineal foot of PVC pipe installed and shall also include all pipe, fittings, onsite and import pipe bedding, backfill, etc., as required by the Drawings and Specifications. This item shall include all subsurface exploration, pipe, connections, and fittings not specifically included in other bid items. (See Section 02222 & 02200)

01019.14 BID ITEMS “18-INCH C905 DR18 PVC TRANSMISSION PIPE”

See Section 02222.4 for Method of Measurement. Payment shall be made by the lineal foot of PVC pipe installed and shall also include all pipe, fittings, onsite and import pipe bedding, backfill, etc., as required by the Drawings and Specifications. This item shall include all subsurface exploration, pipe, connections, and fittings not specifically included in other bid items. (See Section 02222 & 02200)

01019.15 BID ITEM “40 MIL POLYETHYLENE LINER”

This item shall be paid for by the square yard of material in place, which shall be measured to the neat lines of material placed out to the pay limits as required by the Drawings or as coordinated with the ENGINEER. Material must be a minimum of 40 mils thick. (See Section 13810SP)

01019.16 BID ITEM “1-INCH DRAIN GRAVEL”

This item shall be paid for by the cubic yard in place, which shall be measured to the neat lines of compacted materials placed out to the pay limits as required by the Drawings or as coordinated with the ENGINEER. Gravel shall be obtained from a dry source. (See Section 02105.4 & 02105.5)

01019.17 BID ITEM “CLAY CUTOFF WALL”

This bid item shall be paid for by the cubic yard in place for cutoff walls indicated by the Drawings, or as coordinated with the ENGINEER. This item shall include the clay, equipment, labor, etc. required to construct each cut-off wall as intended by the Drawings. (See Section 02250)

01019.18 BID ITEM “MISCELLANEOUS VALVES, FITTINGS, & CONNECTIONS”

This bid item shall be paid for by the lump sum and shall include all items not covered under other bid items but that are required of the CONTRACTOR to tie into and make the connection to the existing spring, ie. cross fitting, tee fitting, MJ adapters, etc. Exploration may be required and connection shall be made as necessary to connect the new pipeline to the existing system and as shown on the Drawings.

01019.19 BID ITEM “SITE CLEANUP & GRADING”

This bid item shall be paid for by the lump sum and shall include all materials, labor, equipment, operations and expenses necessary to perform the final cleanup and grading as coordinated with the ENGINEER and OWNER. All work in this bid item shall be done in accordance with the Drawings and Section 02500 of the Contract Specifications and as coordinated with the ENGINEER. Work shall not be performed without the approval of the ENGINEER.

01019.20 BID ITEM “RESEEDING”

This bid item shall be paid for by the lump sum and shall include all materials, labor, equipment, operations, and expenses to reseed using approved BLM grass mix. All work in this bid item shall be done in accordance with the Drawings and Section 02900 of the Contract Specifications and as coordinated with the ENGINEER.

01019.21 BID ITEM “HATCHERY CORE W/ TIE-IN”

This bid item shall be paid for by the lump sum and shall include all items not covered under other bid items but that are required of the CONTRACTOR to tie into and make the connection to the existing Loa Fish Hatchery building, ie. concrete core, seal core w/ link seal, 2” tee w/ tie-in, 12” tie-in, pipe supports, etc. Connection shall be made as necessary to connect the new 12” pipeline to the existing system and as shown on the Drawings.

ADD ALTERNATE BID ITEMS

01019.22 BID ITEM “INSTALL 18” C905 DR18 BYPASS LINE”

See Section 02222.4 for Method of Measurement. Payment shall be made by the lineal foot of PVC pipe installed and shall also include all pipe, fittings, onsite and import pipe bedding, backfill, etc., as required by the Drawings and Specifications. This item shall include all subsurface exploration, pipe, connections, and fittings not specifically included in other bid items. (See Section 02222 & 02200)

01019.23 BID ITEM “TURBULENT FOUNTAIN”

This item shall be paid for by the lump sum and shall include all materials, equipment, expenses, time, labor, etc. necessary to install the turbulent fountain as intended by the Drawings. This includes but is not limited to the cost of the turbulent fountain frame, concrete pad and walls, interior piping, steel, sealant, untreated base course, wire screen, pipe support, etc. This item shall not apply to bypass line meant to carry water into the turbulent fountain.

01019.24 BID ITEM “REMOVE, DISPOSE, & FILL EXISTING RACEWAY”

This item shall be paid for by the lump sum and shall include all materials, equipment, expenses, time, labor, etc. necessary to remove, dispose, and fill of existing concrete raceways as intended by the Drawings. This includes but is not limited to the cost of removal of existing structure, disposal of all materials, fill with approved imported backfill and compact to 95% max density, cap drain pipes, make pipe connections as required to enable the hatchery to continue operating. The CONTRACTOR shall ensure that all materials are legally disposed of.

01030.1 DESCRIPTION

This section covers project meetings including the pre-construction meeting and other progress and/or work coordination meetings conducted to provide communication and awareness to all parties associated with the Contract.

01030.2 PRE-CONSTRUCTION CONFERENCE

Prior to the commencement of work at the site, a pre-construction conference will be held at a mutually agreed time and place to be arranged by the ENGINEER. The ENGINEER shall also provide notification to all parties expected to attend the meeting. Attendees will include the following:

- ENGINEER
- Project Inspector
- OWNER/OWNER's Representative
- CONTRACTOR/CONTRACTOR's Representative/ Subcontractors as appropriate
- Governmental Representatives as appropriate (State, County, Municipal, etc.)
- Manufacturer/Supplier Representatives/Adjoining CONTRACTORS, as appropriate.
- Utility Service Representatives as appropriate.

01030.2.1 Unless previously submitted to the ENGINEER, the CONTRACTOR shall bring to the conference one copy each of the following:

- Contract construction schedule in accordance with the General Conditions.
- Procurement schedule of major equipment and materials and items requiring long lead-time.
- Shop Drawings, samples or substitution proposals for items proposed as substitutions or "or equal" items.
- Schedule of work that includes the anticipated monthly payment amounts during the contract.
- A Schedule of Values of work to be paid for as lump sum items where partial payment is anticipated.

01030.2.2 The purpose of the conference is to designate responsible personnel and establish a working relationship. Matters requiring coordination will be discussed and procedures for handling such matters established. The agenda may include but not be limited to the following items:

- CONTRACTOR's Work Schedule.
- Transmittal, review, distribution and approval of CONTRACTOR's submittals.
- Processing of applications for payment.
- Maintaining records and documents.
- Critical work sequencing.
- Field decisions and Change Orders.
- Use of project site, office and storage areas, security, housekeeping, and OWNER's needs.
- Major equipment deliveries and priorities.
- Interpretation of Drawings and Specifications.
- CONTRACTOR's responsibilities for safety, first-aid and sanitation.

01030.2.3 The ENGINEER will preside at the pre-construction conference and will arrange for keeping minutes and distributing them to all attendees to the meeting.

01030.3 PROGRESS/COORDINATION MEETINGS

- 01030.3.1 The CONTRACTOR shall conduct regular on-site progress and coordination meetings at least weekly and at other times as requested by ENGINEER or as required by progress of the work. The CONTRACTOR, ENGINEER, and all Subcontractors active on the site shall be represented at each meeting. The CONTRACTOR may, at its discretion, request attendance by representatives of its suppliers, manufacturers, and other Subcontractors. The CONTRACTOR shall be responsible for providing written notification to those deemed necessary for attendance at least 36 hours prior to the time set for the meeting.
- 01030.3.2 The CONTRACTOR shall preside at the meetings and maintain a file of minutes of the proceedings. The purpose of the meetings will be to review the progress of the work, maintain coordination of effort, discuss changes in scheduling, and resolve other problems which may develop.

01090.1 DESCRIPTION

Wherever in these Specifications references are made to the standards, specifications, or other published data of the various national, regional, or local organizations, such organizations may be referred to by their acronyms or abbreviations only. As a guide to the user of these Specifications, the following acronyms or abbreviations, which may appear herein, shall have the meanings indicated below.

01090.1.1 DEFINITIONS OF ABBREVIATIONS AND ACRONYMS

AAR	Association of American Railroads
AASHTO	American Association of the State Highway and Transportation Officials
ACI	American Concrete Institute
ADC	Air Diffusion Council
AGA	American Gas Association
AGC	Associated General Contractors
AGMA	American Gear Manufacturers Association
AI	The Asphalt Institute
AIA	American Institute of Architects
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AMCA	Air Movement and Control Association
ANSI	American National Standards Institute, Inc.
APWA	American Public Works Association
ARI	Air Conditioning and Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASPE	American Society of Plumbing Engineers
ASQC	American Society of Quality Control
ASSE	American Society of Sanitary Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AWWA	American Water Works Association
BLM	Bureau of Land Management (U.S. Department of Interior)
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturer's Association
CGA	Compressed Gas Association
CFR	Code of Federal Regulations
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturer's Institute
CMA	Concrete Masonry Association
CS	Commercial Standard of NBS (U.S. Dept. of Commerce)
CTI	Cooling Tower Institute
DIP	Ductile Iron Pipe
EIA	Electronic Industries Association
EPA	U. S. Environmental Protection Agency
ETL	Electrical Test Laboratories
FEMA	Federal Emergency Management Administration
FERC	Federal Energy Regulatory Commission
FS	Forest Service (U.S. Department of Agriculture)
FWS	Fish and Wildlife Service
GI	Galvanized Iron

IAPMO	International Association of Plumbing and Mechanical Officials
ICBO	International Conference of Building Officials
ID	Inside Diameter
IEEE	Institute of Electrical and Electronics Engineers
IES	Illuminating Engineering Society
IMC	International Mechanical Code
IME	Institute of Makers of Explosives
IPC	International Plumbing Code
ISA	Instrument Society of America
ISO	International Organization for Standardization
MBMA	Metal Building Manufacturer's Association
NACE	National Association of Corrosion Engineers
NBS	National Bureau of Standards
NEBB	National Environmental Balancing Bureau
NEC	National Electrical Code
NEMA	National Electrical Manufacturer's Association
NFGC	National Fuel Gas Code
NFPA	National Fire Protection Association
NFPA	National Forest Products Association
NRCS	Natural Resources Conservation Service (U.S. Department of Agriculture) (formerly SCS)
NSF	National Sanitation Foundation
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
PCA	Portland Cement Association
PDI	Plumbing and Drainage Institute
PE	Polyethylene
PVC	Polyvinyl Chloride
RWMA	Resistance Welder Manufacturer's Association
SAE	Society of Automotive Engineers
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SSPWC	Standard Specification for Public Works Construction
UBC	Uniform Building Code
UL	Underwriters Laboratories, Inc.
UMC	Uniform Mechanical Code
UPC	Uniform Plumbing Code
UPRR	Union Pacific Railroad
USDARD	Rural Development (U.S. Department of Agriculture) (formerly Farmers Home Administration)
WCRSI	Western Concrete Reinforcing Steel Institute
WRI	Wire Reinforcement Institute, Inc.
WWPA	Western Wood Products Association

01090.2 REFERENCED WORKS, CODES AND STANDARDS

Whenever references to specifications, codes, standards and other publications are made to these Specifications, the following rules shall apply:

01090.2.1 TITLES OF SECTIONS AND PARAGRAPHS

Titles of sections and/or paragraphs shown in these Specifications are for convenience of reference only, and do not form a part of the Specification.

01090.2.2 APPLICABLE PUBLICATIONS

Whenever references in these specifications are made to published specifications, codes, standards, or other requirements, it shall be understood that unless a date is specified, only the latest edition of these specifications, codes, and/or standards which have been published as of the date that the work is advertised for bids, shall apply; except to the extent that said standards or requirements may be in conflict with applicable laws, ordinances, or governing codes. No requirements set forth herein or shown on the Drawings shall be waived because of any provision of, or omission from, said standards or requirements.

01090.2.3 SPECIALISTS AND SPECIAL ASSIGNMENTS

In certain instances, specification text requires (or implies) that specific work is to be assigned to specialists or expert entities, who must be engaged for the performance of that work. Such direction shall be recognized as special requirements and is not intended to interfere with local union jurisdiction settlements and similar conventions. Such assignments are intended to establish which party or entity involved in a specific unit of work is recognized as "expert" and qualified for the assignment of the work. Nevertheless, the final responsibility for fulfilling this assignment remains with the CONTRACTOR.

01090.2.4 BUILDING CODES

Reference herein to "Building Code" shall mean the Uniform Building Code issued by the International Conference of Building Officials (ICBO). The latest edition of the code as approved and used by the local agency as of the date of award, as adopted by the agency having jurisdiction, shall apply to the work herein, including all addenda, modifications, amendments, or other lawful changes thereto.

01090.2.5 OSHA

01090.2.5.1 OSHA REGULATIONS - References herein to "OSHA Regulations for Construction" shall mean Title 29, Part 1926, Construction Safety and Health Regulations, Code of Federal Regulations (OSHA), including all changes and amendments thereto.

01090.2.5.2 OSHA STANDARDS - References herein to "OSHA Standards" shall mean Title 29, Part 1910, Occupational Safety and Health Standards of the U.S. Code of Federal Regulations, including all changes and amendments thereto.

01090.2.6 DOT STANDARDS/SPECIFICATIONS

References to "State DOT Specifications" or "State DOT Requirements" shall mean the Specifications for Excavation on State Highway Right-of-Way and/or Standard Specifications for Road and Bridge Construction, including all amendments thereto, issued by the State agency responsible for highways wherein the Contract is located and any other written requirements or provisions issued by that agency which are contained in these Contract Documents.

01090.2.7 FEDERAL PIPELINE SAFETY STANDARDS

Reference to "Federal Pipeline Safety Standards" shall mean Title 29, Parts 191 and 192, Federal Pipeline Safety Minimum Standards, U.S. Code of Federal Regulations including all changes and amendments thereto.

01090.2.8 STATE GAS PIPELINE SAFETY STANDARDS

References to "State Gas Pipeline Safety Standards" shall mean the appropriate section/s of the legal code or regulations adopted in the State wherein the work is located, including all changes and amendments thereto.

01090.3 STANDARDS IMPOSED BY OTHER AGENCIES OR ORGANIZATIONS**01090.3.1 PROPERTY BELONGING TO OTHER AGENCIES OR ORGANIZATIONS**

Construction may occur on property owned or administered by agencies or organizations other than the OWNER, such as federal and/or state departments of transportation, the U. S. Forest Service, the U. S. Bureau of Land Management, the U.S. Fish and Wildlife, counties, canal companies, irrigation companies, utility companies, other federal and state agencies, municipal governments, etc. Work which is to take place on such property may be required to be in accordance with special construction requirements of that agency or organization as well as these specifications.

01090.3.2 ADDITIONAL INFORMATION AND SPECIFICATIONS

Information will be provided on the plans to indicate areas of the Work which fall on property owned or administered by agencies and organizations other than the OWNER. Specifications from agencies which are affected by the work will be provided in the Appendix to the Contract Documents. Those specifications provided in the Appendix shall be considered part of the Contract Documents and the CONTRACTOR shall include sufficient compensation in its bid to cover the work required for compliance thereto.

01090.4 CONFLICTS

In case of conflict between codes, reference standards, Drawings and the other Contract Document, the most stringent requirements shall govern. All conflicts shall be brought to the attention of the ENGINEER for clarification and directions prior to ordering or providing any materials or labor required therefrom. The CONTRACTOR shall assume the most stringent requirements apply when preparing bids for this Contract.

01200.1 DESCRIPTION

The purpose of this section is to clarify certain aspects of the Project and the Contract that must be taken into consideration and completed before final acceptance of the Work can be given. These items include cleanup, demonstration of acceptable performance of equipment and facilities furnished and installed, submittals, payment for all work completed, issuance of final acceptance documentation, accepted repair and restoration of work and materials found defective during the warranty period. Specific instructions are provided herein for completion of the Work in such a manner that it will be fully acceptable and that the CONTRACTOR will be eligible for receipt of final payment.

01200.1.1 **RELATED WORK AND REFERENCED SECTIONS**

Not used.

01200.1.2 **SUBMITTALS**

Section 01300 - Submittals
See paragraph 01200.3.5 below.

01200.1.3 **DEFINITIONS**

Not used.

01200.2 MATERIALS

Not used.

01200.3 CONSTRUCTION REQUIREMENTS01200.3.1 **CLEANUP**

The OWNER will not give final acceptance of the Work until the CONTRACTOR has satisfactorily complied with the finishing and cleanup requirements contained in these Contract Documents and with any applicable local regulations. The CONTRACTOR shall accomplish the cleanup operations so as to leave the work site in an orderly, acceptable, and presentable condition.

01200.3.2 **REPAIR AND RESTORATION**

All major and minor damage to improvements and finished surfaces resulting from the CONTRACTOR's performance of the Work, whether to materials and equipment located on the project site or to those constructed under this Contract, shall be repaired to an original, or like-new, condition before final acceptance will be provided by the ENGINEER and OWNER. Where damage to surfaces or materials can not be sufficiently repaired or restored, in the opinion of the ENGINEER, the CONTRACTOR may be required to replace the entire surface covering or structural member to achieve an original or like-new condition of the surface or material.

01200.3.3 **TESTING**

All performance and operational testing of facilities and equipment required by the Contract Documents, together with any required supportive documentation, shall be completed by the CONTRACTOR and approved by the ENGINEER prior to final acceptance of the Work.

01200.3.4 ACCEPTANCE FROM PROPERTY OWNER

The CONTRACTOR shall obtain a written release from each property owner on whose property work has been required by these Contract Documents. Such release shall indicate the property OWNER's approval of the restoration and/or replacement of all disturbed improvements, surfaces and structures. Any request made to the CONTRACTOR by a private property owner, and determined to be unreasonable in the opinion of the ENGINEER, may be waived by the OWNER.

01200.3.5 SUBMITTAL OF MANUFACTURER'S DOCUMENTATION

All guarantees and warranties, operation and maintenance manuals or brochures, or other materials furnished to the CONTRACTOR by the manufacturer for any equipment or material used for the Work shall be delivered to the OWNER in protective 3-ring binders. Retainage held to the CONTRACTOR in accordance with the General Conditions of the Contract Documents will not be released until such documentation is submitted. See Section 01300 for more detail regarding O&M manuals.

01200.3.6 FINAL ACCEPTANCE

01200.3.6.1 CONTRACTOR'S STATEMENT OF COMPLETION - When the CONTRACTOR has completed the Work under this contract, including all of the CONTRACTOR's testing and clean-up, the CONTRACTOR shall inform the ENGINEER in writing that the Work has been completed and request a final inspection by the ENGINEER. The ENGINEER will then conduct a final inspection with the OWNER and representatives of the pertinent funding and regulatory agencies. If items are found by the ENGINEER to be incomplete or not in compliance with the contract requirements, the ENGINEER will inform the CONTRACTOR of such items. After the CONTRACTOR has completed these items, the procedure shall then be the same as described above for the CONTRACTOR's statement of completion and request a final inspection.

01200.3.6.2 NOTICE OF FINAL ACCEPTANCE - After the ENGINEER has determined that all work required under the Contract Documents has been completed and that all of the considerations specified herein above are satisfactorily concluded, the ENGINEER will recommend to the OWNER, in writing, that final acceptance of the entire Work under this contract be made as of the date of the ENGINEER's final inspection. The OWNER and ENGINEER will then indicate formal approval and acceptance of the Work by issuing the "Notice of Final Acceptance" form.

01200.3.6.3 NO PARTIAL ACCEPTANCE - Unless otherwise required by Special Provisions, partial acceptance of any portion of the Work will not be made. While Substantial Completion notice can be issued in accordance with the General Conditions to allow use of completed work for its intended purpose, no acceptance other than the final acceptance of all completed work will be made. No inspection or approval or Notice of Substantial Completion pertaining to specific parts of the work shall be construed as final acceptance of any part until written final acceptance of all work is issued.

01200.4 METHOD OF MEASUREMENT

Not used.

01200.5 BASIS OF PAYMENT

Not used.

01300.1 DESCRIPTION

This section covers procedures to be followed by the CONTRACTOR when providing information to the OWNER and/or ENGINEER to obtain approval of materials, equipment, procedures, etc. described in the Specifications and Drawings.

01300.2 SHOP DRAWINGS AND MATERIALS SUBMITTALS**01300.2.1 NUMBER OF COPIES OF SUBMITTALS**

The CONTRACTOR shall furnish six (6) copies of each shop drawing and pertinent materials information sheet to the ENGINEER for review. A full set of submittals shall be provided to the ENGINEER seven (7) days prior to commencement of construction activity. Following review and approval, two copies shall be returned to the CONTRACTOR for his records, two shall be retained by the ENGINEER for inspection and verification purposes, and two shall go to the OWNER as working and archival records.

01300.2.2 SHOP DRAWINGS

01300.2.2.1 CONTRACTOR REVIEW - The CONTRACTOR's shop drawing submittals shall be reviewed by a qualified representative of the CONTRACTOR, prior to submission to the ENGINEER. Such review shall be made to ensure the accuracy and compliance with the technical requirements and performance described and illustrated in the Drawings and Specifications.

01300.2.2.2 CONTENT - Shop drawings shall include drawings, pictures and sketches with sufficient details and explanations to reflect the CONTRACTOR's interpretations of components and required configurations not shown on the Drawings, so that a documented record of such can be approved for incorporation in the Work. These Drawings shall be accurate, distinct, and complete and shall contain all required information, including satisfactory identification of items and unit assemblies in relation to the Drawings and/or Specifications.

01300.2.2.3 TIMELY SUBMITTAL - Shop drawings shall be submitted sufficiently in advance to allow the ENGINEER not less than ten regular working days prior to manufacturing for examining the Drawings.

01300.2.2.4 ENGINEER APPROVAL - When the shop drawings are approved by the ENGINEER, two sets of copies will be returned to the CONTRACTOR marked "Approved", "Revise as Noted", "Rejected", "Approved Except as Noted", or similar notification. If changes or corrections are necessary, one set will be returned to the CONTRACTOR with such changes or corrections indicated by a brief statement, and the CONTRACTOR shall correct and resubmit the Drawings, in triplicate, to the ENGINEER.

Fabrication work shall not commence until the ENGINEER has reviewed the pertinent shop drawings and returned copies to the CONTRACTOR marked either "Approved" or "Approved - Except as Noted". Corrections indicated on such submittals shall be considered as changes necessary to meet the requirements of the Contract Documents and shall not be taken as the basis of claims for extra work.

Approval of shop drawings will not be required for reinforcing steel that is detailed by the CONTRACTOR in accordance with the Plans and Specifications. Any change from the Plans and Specifications made by the CONTRACTOR in any aspect of the Work shall be approved by the ENGINEER in a written Change Order prior to any work being altered from that already approved for construction.

001300.2.3 MATERIALS INFORMATION SUBMITTALS

In keeping with 01300.2.1 above, the CONTRACTOR shall assemble and submit six (6) original copies of each manufacturer's catalog cuts and materials information sheets pertaining to materials and equipment to be furnished and installed in the Work. These submittals shall be enclosed in 3-ring binders. Failure to submit all materials information may result in the CONTRACTOR's partial payments to be withheld until submittals are complete. Photocopies of the catalog cuts and information sheets will not be acceptable as submittals without prior authorization from ENGINEER.

01300.2.4 CONTRACTOR LIABILITY

The CONTRACTOR shall assume all responsibility and risk for any re-work or other costs resulting from errors in CONTRACTOR submittals. The CONTRACTOR shall be responsible for showing accurate dimensions and details of connections required to ensure the function of the equipment and/or component of the Work being illustrated.

01300.3 SAMPLES**01300.3.1 NUMBER OF SUBMITTALS**

Whenever requested by the ENGINEER, the CONTRACTOR shall submit at least one sample of each item or material indicated in the Specifications to the ENGINEER for inspection and acceptance and do so at no additional cost to the OWNER.

01300.3.2 TIMELY AND ORDERLY SUBMITTAL

Samples shall be submitted sufficiently in advance of placement of orders that the ENGINEER shall have not less than ten regular working days for examining and testing the material for acceptance prior to delivery to the job site. Samples shall be submitted in an orderly sequence and appropriately identified so that dependent materials or equipment can be assembled and reviewed without causing delays in the work or mistakes in their identity.

01300.3.3 SELECTION OF COLORS AND TEXTURES

Unless otherwise specified, the OWNER and the ENGINEER will select all colors and textures of specified items from the manufacturer's standard colors and standard materials, products, or equipment lines.

01300.4 OPERATIONS AND MAINTENANCE MANUALS**01300.4.1 STRUCTURE OF OPERATIONS AND MAINTENANCE MANUALS**

The CONTRACTOR shall furnish to the OWNER four (4) identical sets of Operations and Maintenance manuals. Each set shall consist of one or more volumes, each of which shall be bound in a standard size, 3-ring, loose-leaf, vinyl plastic, hard cover binder suitable for bookshelf storage. Binder ring size shall not exceed 2.5 inches. A Table of Contents shall be provided which indicates all equipment in the Operations and Maintenance manuals.

01300.4.2 CONTENTS

The CONTRACTOR shall include in the Operations and Maintenance Manuals the following information for each item of mechanical, electrical, and instrumentation equipment:

- Care and maintenance of all finished exposed surfaces.
- Complete operating instructions, including location of controls, special tools or other equipment required, related instrumentation, and other equipment needed for operation.
- Preventive maintenance procedures and schedules.
- Complete parts lists, by generic title, identification number, and catalog number, complete, with exploded views of each assembly.
- Disassembly and reassembly instructions.
- Name and location of nearest supplier and spare parts warehouse.
- Name and location of manufacturer.
- Recommended start-up, testing and troubleshooting procedures.
- Prints of the record drawings, including diagrams and schematics, as required under the electrical and instrumentation portions of these specifications.

01300.4.3 SCHEDULE OF DELIVERY

Operations and Maintenance manuals shall be submitted in final form to the OWNER before seventy-five (75) percent of the Work is completed. Any discrepancies found by the OWNER and ENGINEER in the Operations and Maintenance manuals shall be corrected by the CONTRACTOR prior to final acceptance of the project.

01300.5 SCHEDULE OF VALUES

At the time of the pre-construction conference, the CONTRACTOR shall submit a Schedule of Values of the Work measured as lump sum bid items. On the Schedule, those items shall be subdivided into component parts in sufficient detail as to form a basis for determining progress payments during construction. Quantities, and/or prices, shown on the Schedule shall equal the total contract price for each lump sum item. Information provided on the Schedule will be reviewed and approved by the ENGINEER when found acceptable. That information will then be incorporated into the data used for preparing the Application for Payment by the ENGINEER.

01300.6 CONTRACT CONSTRUCTION SCHEDULE

A construction schedule, prepared in accordance with requirements of the General Conditions, shall be submitted to the ENGINEER at the pre-construction conference. Unless required otherwise in Special Provisions, such schedule shall show the anticipated time of completion, approximate start dates of identifiable segments of the Work, and anticipated value of the work expected to be completed in monthly time periods within the contract period.

01300.7 PROCUREMENT SCHEDULE

At the time of the pre-construction meeting (see Section 01030), the CONTRACTOR shall submit a procurement schedule to the ENGINEER. This plan shall include all equipment and materials required for the Work included in the Contract that are not readily available and will require off-site manufacture and lead time which can affect the progress of the Work. The plan shall show at least the following information:

- Equipment/Material Name
- Anticipated amount of time for ordering, manufacturing, and shipping to Work site.
- Anticipated dates for ordering, receiving and installing.

01300.8 CONSTRUCTION PHOTOGRAPHY RECORDS

When required in the Contract Documents and prior to commencement of any of the Work, the CONTRACTOR shall prepare colored CD photography records of all areas of the Contract work site and provide copies of such records to the ENGINEER. Such records shall become the property of the OWNER and may be used for determining the condition of work sites and degree of restoration required for completion of the Work (see also Section 2000).

01400.1 DESCRIPTION

This section covers quality control of all work and activities on the part of the OWNER, the ENGINEER, and the CONTRACTOR, to ensure compliance with these Specifications and the requirements of the Contract.

01400.2 ASSIGNMENT OF RESPONSIBILITY**01400.2.1 THE CONTRACTOR**

The CONTRACTOR has primary responsibility for ensurance of quality control of the Work provided under the Contract. Therefore, any omission or failure on the part of the ENGINEER to notify the CONTRACTOR of, or to condemn defective work and/or materials at the time of construction shall not be taken as acceptance of the work or materials, and the CONTRACTOR will be required to correct any defective work or materials prior to final acceptance.

01400.2.2 THE OWNER AND ENGINEER

The ENGINEER will endeavor to locate any errors or defective materials or workmanship, and call them to the attention of the CONTRACTOR prior to subsequent work being performed. However, the ENGINEER is under no obligation to do so, and neither the OWNER, nor the ENGINEER shall be held liable for errors, or defective material, or defective workmanship performed by the CONTRACTOR and not discovered by the ENGINEER prior to subsequent work being performed.

01400.2.3 CORRECTIONS

Prior to execution of the Agreement, the ENGINEER may correct errors and omissions to these Contract Documents by issuing Addenda. After execution of the Agreement, correction of errors, omissions or other changes necessitated shall be made in accordance with the General Conditions (Section 00700).

01400.3 QUALITY OF MATERIALS**01400.3.1 COMPLIANCE WITH SPECIFICATIONS**

All materials and equipment incorporated in the Work shall be of new manufacture and shall be of the grade and quality described by these Specifications and the Special Provisions.

01400.3.2 SPECIFIED MATERIALS

Where a specific brand or manufacturer's equipment, model, system, or etc. is specified in these Specifications, no intention is made to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance.

01400.3.3 SUBSTITUTION OF MATERIALS

The ENGINEER, in accordance with the General Conditions (Section 00700.8), may allow substitution of equipment or materials. The OWNER reserves the right to reject substitutions if, in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

01400.4 QUALITY OF WORK

All workmanship incorporated in the Work covered by the Contract is to be of the grade and quality described by these Specifications and the Special Provisions.

01400.5 INSPECTION**01400.5.1 AUTHORITY AND DUTIES OF INSPECTOR**

01400.5.1.1 AUTHORITY - Inspectors representing the ENGINEER are authorized to inspect all work performed and all materials furnished and to reject defective material and any work that is improperly performed, subject to the final decision of the ENGINEER. This authority extends to all or any part of the Work, including the preparation, fabrication, or manufacture of any materials or equipment to be used for completion of the Work. The Inspector is not authorized to alter or waive the provisions of these Specifications or other provisions of the Contract Documents. The ENGINEER may delegate additional authority to the Inspector when such action is determined to be necessary.

01400.5.1.2 DUTIES - Inspectors keep the ENGINEER informed as to the progress of the Work and the manner in which it is performed. Inspectors are also assigned to call the CONTRACTOR's attention to any observed nonconformance with the Contract Documents. The Inspector will not act as foreman for the CONTRACTOR.

01400.5.2 INSPECTION OF MATERIALS

01400.5.2.1 TESTING - In accordance with the Contract Documents and at the option of the ENGINEER, materials to be supplied under this contract will be tested and/or inspected either at their place of origin or at the site of the Work. The CONTRACTOR shall give the ENGINEER written notification well in advance of actual readiness of materials to be tested and/or inspected at the point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material nor shall it preclude re-testing or re-inspection at the site of the Work.

01400.5.2.2 SAMPLES - The CONTRACTOR shall furnish such samples of materials as are requested by the ENGINEER, without charge. No material shall be incorporated into the Work until the ENGINEER has approved it (see Section 01300).

01400.5.3 CONTRACTOR LIABILITY

The inspection of the Work shall not relieve the CONTRACTOR of any of its obligations to fulfill its contract as herein provided, and unsuitable materials may be rejected notwithstanding that such unsatisfactory performance may have been overlooked and accepted or estimated for payment.

01500.1 DESCRIPTION

Covers requirements for aptness, competency, quality, and quantity in the labor, equipment, tools, and materials supplied by the CONTRACTOR for execution of the Work.

01500.2 REQUIREMENTS

In order to bring the Work to completion in the manner and on the time schedule required by the Contract Documents, the CONTRACTOR shall provide sufficient labor and equipment with adequate training and capability as follows:

- The CONTRACTOR shall employ sufficient labor and equipment with adequate training and capability for executing the Work to full completion in the manner and time required by these Specifications.
- All workers shall have sufficient skill and experience to perform properly the work assigned to them. Workers engaged in special work or skilled work shall have appropriate training and sufficient experience in such work, in the opinion of the ENGINEER, to perform all work properly and satisfactorily.
- Any person employed by the CONTRACTOR or by any Subcontractor who, in the opinion of the ENGINEER, does not perform their work in a proper and skillful manner or is intemperate or disorderly shall, at the written request of the ENGINEER, be removed forthwith by the CONTRACTOR or Subcontractor employing such person. Such person(s) shall not be employed again in any portion of the Work without the approval of the ENGINEER. When such action is considered, and if requested by that employee, a hearing attended by the employee, ENGINEER, and CONTRACTOR shall be conducted before final dismissal action is taken.
- Should the CONTRACTOR fail to remove such person or persons as required above or fail to furnish suitable and sufficient personnel for the proper execution of the Work, the ENGINEER may suspend the Work by written notice until such order is complied with.
- All equipment, which is proposed to be used on the Work, shall be of sufficient size and in such mechanical condition, in the opinion of the ENGINEER, as to produce a satisfactory quality of Work. Equipment used on any portion of the Work shall be fitted with appropriate protective devices in accordance with OSHA and other applicable safety regulations such that no injury to employees, the Work, or to adjacent property will result from its use.
- When the specific methods and equipment to be used by the CONTRACTOR in accomplishing the Work are not described in the Contract Documents, the CONTRACTOR is free to use any methods or equipment that will accomplish the Work in conformity with the requirements of this Contract.

01510.1 DESCRIPTION

This section covers measures and instructions for prevention of damage to existing structures and utilities, whether above ground or underground, during execution of the Work of the Contract.

01510.2 PROTECTION OF EXISTING UTILITIES**01510.2.1 INTEGRITY OF UTILITIES**

The CONTRACTOR shall be responsible for safeguarding and maintaining the integrity of all conflicting utilities. This responsibility includes securing the assistance of available utility location services in the area in which the Work is being performed. The ENGINEER has attempted to show the location of all utilities anticipated to conflict with the Work. However, when a conflicting utility line is discovered that was not shown on the Plans, the CONTRACTOR shall contact the utility's OWNER and notify the ENGINEER immediately for resolution of the conflict. When realignment or relocation of the Work, or relocation of the conflicting utility is deemed necessary, the ENGINEER shall give direction in writing for the CONTRACTOR to proceed. Work resulting from such direction may be treated as a changed condition, and appropriate authorization and payment will be made in accordance with the General Conditions.

01510.2.2 LOCATING UTILITIES

It shall be the responsibility of the CONTRACTOR to locate and expose or identify all existing utilities, both underground and overhead, for the purpose of preventing damage to them. The CONTRACTOR shall notify all concerned utility offices at least 48 hours in advance of construction operations in which a utility agency's facilities may be involved. This shall include, but not be limited to, irrigation water, culinary water, telephone, gas, and electric.

01510.2.3 CHANGES TO UTILITIES

The CONTRACTOR shall be responsible for any and all changes to, or re-connections to, public utility facilities encountered or interrupted during execution of the Work, and all costs related thereto shall be borne by the CONTRACTOR. The CONTRACTOR shall negotiate with, and pay, the respective utility agency for work it must do in connection with moving, repairing, or restoring its utility(s). The CONTRACTOR shall further make all necessary notifications, scheduling, coordination, and management of details related to any such interference. The potential or projected cost of any public utility interference shall be included in the CONTRACTOR's price covering the major Contract Item to which the interference or changes are attributable.

01510.2.4 MAINTENANCE OF SERVICE

01510.2.4.1 CONTINUOUS SERVICE - Unless otherwise required in the Contract Documents, all utilities, both underground and overhead, shall be maintained in continuous service throughout the entire contract period. The CONTRACTOR shall be responsible and liable for any damages to or interruption of service caused by the construction.

01510.2.4.2 ACCIDENTAL INTERRUPTION OF SERVICE - In the event of interruption of other utility services as a result of accidental breakage, the CONTRACTOR shall promptly notify the appropriate responsible authority. The CONTRACTOR shall then cooperate with that authority in restoration of service as soon as possible, and shall bear all cost of repair. In no case shall interruption of any water or other utility service be allowed outside working hours unless the ENGINEER has issued prior authorization. When changeover of service connections to new

utility lines becomes necessary, interruptions of individual services for periods of up to 8 hours will be allowed providing 24 hour advance notice has been given to affected users.

- 01510.2.4.3 **TEMPORARY INTERRUPTION AND RELOCATION** - If the CONTRACTOR desires to temporarily or permanently relocate or shut down any utility or appurtenance, the CONTRACTOR shall make the necessary arrangements and agreements with the owner or operator of the respective utility and shall be completely responsible for all costs concerned with the relocation or shutdown and reconstruction. Shutdown and relocation and/or reconstruction shall be subject to inspection and approval by the ENGINEER and the owner of the utility.

01510.3 PROTECTION OF PROPERTY AND EXISTING STRUCTURES

- 01510.3.1 **REMOVAL OR RELOCATION OF PROPERTY** - All property removed or relocated by the Work shall be reconstructed in its original or new location as soon as possible. Restoration of existing property or facilities shall be to a condition as good or better than its original condition.

- 01510.3.2 **DAMAGE TO PROPERTY** - All property damaged by the CONTRACTOR, whether inside or outside the limits of easements provided by the OWNER, shall be the responsibility of the CONTRACTOR. All such damages shall be repaired with like material and restored to its original condition, or better. Such repair or restoration shall be accomplished at the CONTRACTOR's expense without additional compensation from the OWNER.

01510.4 PROTECTION OF PAVED SURFACES

To avoid unnecessary damage to paved surfaces, tracked equipment shall use rubber cleats or paving pads when operating on or crossing all existing paved surfaces unless authorized otherwise in writing by the ENGINEER.

01510.5 RIGHTS-OF-WAY AND EASEMENTS

- 01510.5.1 **MINIMAL DISTURBANCE OF RIGHTS-OF-WAY** - When construction easements have been obtained by the OWNER, the CONTRACTOR shall take appropriate measures to minimize disturbances to surface improvements within the easements. The CONTRACTOR shall obtain a signed release from each property owner, approving restoration work in the construction easements across its respective property(s).

- 01510.5.2 **CONSTRUCTION AREAS** - The CONTRACTOR shall confine construction operations to the area within the dedicated rights-of-way for public thoroughfares, or within areas for which construction easements have been obtained, unless the CONTRACTOR has made separate special agreements with the affected property owners in advance.

- 01510.5.3 **PROPERTY OWNER NOTIFICATION** - The CONTRACTOR shall give at least 48 hours advance notification of commencement of construction to property owners having land on which construction will take place. During all construction operations, the CONTRACTOR shall construct and maintain such facilities as may be required to provide access by all property owners to their property. No one shall be cut off from access to their property for a period exceeding eight (8) hours unless the CONTRACTOR has made special arrangements with the affected persons. The CONTRACTOR shall grade all disturbed surfaces required for motor vehicle traffic at least daily unless directed otherwise in the Contract Documents or in writing by the ENGINEER.

01520.1 DESCRIPTION

This Section includes requirements that shall be followed by the CONTRACTOR, to protect the environment, while performing work under this contract. The CONTRACTOR shall also comply with any applicable additional requirements made by federal, state, or local government agencies.

01520.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 00700 – General Conditions, paragraph 32 (for RDA funded projects)

01520.1.2 SUBMITTALS

Section 01300 – Submittals.

01520.1.3 DEFINITIONS

Not used.

01520.2 MATERIALS

Not used.

01520.3 CONSTRUCTION REQUIREMENTS**01520.3.1 EXPLOSIVES AND BLASTING**

The use of explosives on the work will not be permitted unless approved otherwise in the Contract Documents or in writing by the ENGINEER.

01520.3.2 DUST ABATEMENT

01520.3.2.1 CONTROL MEASURES - The CONTRACTOR shall furnish all labor, equipment, water and means required to provide effective dust control and abatement measures. Control measures shall be applied as often as necessary and wherever directed in writing by the ENGINEER, to prevent construction operations from producing dust in amounts that may be damaging to property, vegetation, or animals, or detrimental to persons within reasonable proximity of the work site.

01520.3.2.2 HAUL ROUTES AND WORK SITES - The CONTRACTOR shall identify haul routes or material handling areas, outside of the Work site, whereon dust may be generated, and shall exercise appropriate measures to abate any dust problem caused by its operation. Such dust abatement measures shall be taken immediately when observed or when required in writing by the ENGINEER.

01520.3.3 STORM AND GROUND WATER

01520.3.3.1 PERMITS REQUIRED - If a storm water NPDES permit is required, the CONTRACTOR is responsible to obtain such permit and comply with the conditions thereof.

01520.3.3.2 CONTROL MEASURES - The CONTRACTOR shall provide and maintain, at all times during construction, ample means and devices to promptly remove all water entering the Work, whether the water is surface or ground water. Water removed by the CONTRACTOR shall be directed into ponds or areas separated from live streams or drainage ways, to keep sediment from entering live water.

- 01520.3.3.3 DRAINAGE PATTERNS - In excavation, fill, and grading operations, the CONTRACTOR shall take care, to disturb the existing drainage pattern as little as possible. Particular care shall be taken not to direct drainage water onto private property or into streets or drainage ways inadequate for the increased flow.
- 01520.3.3.4 FORDING OF WATERWAYS - Fording of live streams or any body of live water to accomplish the Work shall not be permitted. Mechanized equipment also shall not be operated in live water to accomplish the Work unless authorized in writing by the ENGINEER, or in the Contract Documents.
- 01520.3.3.5 FILLING OF WATERWAYS - The ENGINEER will not approve the filling of any ditches, washes, drainage ways, streams, wetlands, or other surface waters by the CONTRACTOR to accomplish the Work unless specific instructions are included in the Contract Documents which will provide for how the affected drainages or surface waters are to be treated.
- 01520.3.4 NOISE ABATEMENT
- In or near inhabited areas, particularly residential areas, the CONTRACTOR's operations shall be performed in a manner to prevent noise from becoming a nuisance or problem. Particular consideration shall be given to noise generated by repair and service activities during the night hours.
- 01520.3.5 CHEMICALS
- All chemicals and/or petroleum based products used during project construction or furnished for project shall be handled, applied and disposed of in strict accordance with the printed instructions of the manufacturer and regulations enforced by Federal, State and Local health authorities.
- 01520.3.6 WASTE AND SURPLUS MATERIALS DISPOSAL
- 01520.3.6.1 CLEAN WORK SITE - The CONTRACTOR shall keep the work site, haul roads and other areas of use in a neat, clean condition, free from any accumulation of surplus materials. It shall be the responsibility of the CONTRACTOR, at its own expense, to remove and legally dispose of all surplus materials resulting from all Work activities performed in accordance with the Contract Documents.
- 01520.3.6.2 SURPLUS MATERIAL - Surplus material includes, but is not limited to, salvaged materials and equipment that otherwise would have been abandoned in place, rocks too large to be used as backfill, wood and other organic or unsuitable materials, trash, rubbish, and waste products of any nature, and any other debris generated by the Work.
- 01520.3.6.3 REGULATORY COMPLIANCE - Disposal of surplus materials shall be accomplished in accordance with all local codes, laws, ordinances, and all applicable safety laws (particularly to the requirements of Part 1926 of the OSHA Safety and Health Standards for Construction) in affect at the approved disposal site. In no case shall it be acceptable for any surplus material to be disposed of in streams, marshes or wetlands.
- 01520.3.6.4 APPROVAL OF DISPOSAL - The ENGINEER will not approve any disposal operation, which creates an unsightly and/or unsanitary nuisance. The CONTRACTOR shall maintain disposal sites in a reasonable condition of appearance during construction. When designated and/or public disposal sites are unavailable, written approval must be obtained from the ENGINEER to dispose of any surplus materials on any other site. All disposal sites are subject to approval by the ENGINEER. The CONTRACTOR shall secure permission and all permits required for use of any dumpsite not previously arranged and designated by the OWNER. The CONTRACTOR shall

retain copies, and provide copies upon request, of all disposal permits and/or agreements obtained for the Contract Work.

01520.3.6.5 SCHEDULED REMOVAL - The CONTRACTOR shall establish regular intervals of collection and disposal of surplus materials during construction. Stockpiling of surplus materials for later disposal will not be approved or allowed.

01520.3.7 OPEN BURNING

Open burning of materials may be allowed only in strict accordance with all regulations in effect for the area at which the burning would be performed, and the CONTRACTOR shall obtain any necessary permits from the appropriate governing entity prior to the start of burning. The CONTRACTOR shall not allow fire to spread beyond the material intended for burning. No accumulation of residue from burning shall remain on or adjacent to the construction site, without written approval of the ENGINEER.

01520.3.8 SANITATION

01520.3.8.1 TOILETS - The CONTRACTOR shall provide fixed or portable chemical toilets for employee use in conformance with the requirements of Part 1926 of the OSHA Standards for Construction and when public toilets are not available or within fifteen (15) minutes walking distance of the Work site.

01520.3.8.2 COLLECTION OF WASTES - The CONTRACTOR shall be responsible for daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the CONTRACTOR shall be disposed of away from the site in accordance with all laws and regulations pertaining thereto.

01520.3.9 HAZARDOUS MATERIAL

01520.3.9.1 REGULATORY COMPLIANCE - Disposition of any hazardous material or toxic or hazardous waste shall be made in accordance with the requirements and regulations administered by the State agency wherein the Work site is located.

01520.3.9.2 ABNORMAL CONDITONS - Abnormal conditions include, but are not limited to, the following: buried barrels with liquid or solid contents; buried or above ground tanks with liquid contents; obnoxious odors; excessively hot earth; stained and discolored soils; smoke; unidentifiable powders, sludge, pellets; or any other similar condition.

01520.3.9.3 DISCOVERY AND NOTIFICATION - If any abnormal conditions are encountered during construction, which indicate the presence of a hazardous material, toxic, or hazardous waste, the CONTRACTOR shall immediately suspend work in the area of the discovery and notify the ENGINEER and treat the situation with extreme caution. The CONTRACTOR's operation in the area of discovery shall not resume until so directed by the ENGINEER; however, the CONTRACTOR shall continue working in other areas of the project, unless otherwise directed by the ENGINEER.

01520.3.9.4 DISPOSAL - When it becomes necessary for the CONTRACTOR to dispose of discovered materials, the work may be considered a change and administered in accordance with the General Conditions. Should the disposition of discovered waste material require special procedures or handling by certified personnel, the CONTRACTOR will make all such arrangements. When it becomes necessary to obtain permits for transporting or handling discovered material, the OWNER will obtain the permits.

- 01520.3.9.5 SPILLS AND NOTIFICATION - In the event of spills of petroleum-based products or hazardous wastes by the CONTRACTOR, the CONTRACTOR shall immediately notify the ENGINEER. The CONTRACTOR shall also notify the appropriate State environmental enforcement agency, unless the spill consists of less than one (1) gallon of petroleum based products. In no case will notification be made later than 24 hours after the discovery of the spill. In addition, written notification shall also be made within 5 calendar days of the discovery.
- 01520.3.9.6 COST OF CLEANUP - All costs for cleanup and disposal of hazardous materials due to spills, inappropriate handling, or negligence of the CONTRACTOR shall be borne by the CONTRACTOR.
- 01520.3.10 ENVIRONMENTAL COMPLIANCE
- 01520.3.10.1 REGULATORY COMPLIANCE - The CONTRACTOR shall comply with the applicable requirements of the National Historic Preservation Act as it relates to the preservation of ALL environmental resources. Clearance for protection of environmental resources located within the designated Work site is the responsibility of the OWNER and such clearance has been obtained for the Contract, unless provided for otherwise in the Contract Documents.
- 01520.3.10.2 DISCOVERY OF HISTORIC/ARCHEOLOGICAL OBJECTS – The CONTRACTOR shall observe the following:
- DISCOVERY AND NOTIFICATION - If a suspected or unsuspected historic, archeological, or paleontological item, feature, or site is encountered, construction operations shall be immediately stopped in the vicinity of the discovery and the ENGINEER shall be notified of the nature and exact location of the findings. The CONTRACTOR shall not damage the discovered objects and shall provide written confirmation of the discovery to the ENGINEER within two (2) calendar days.
 - RESTRICTION OF CONSTRUCTION - Should operations in the vicinity of a discovery be restricted, the ENGINEER will keep the CONTRACTOR informed concerning the status of the restriction. The CONTRACTOR should be aware that the time necessary for the OWNER to negotiate the handling of the discovered is variable and is dependent on the nature and condition of the circumstances. It is possible that a delay of as much as three weeks in the vicinity of the discovery can be expected. The ENGINEER will inform the CONTRACTOR when the restriction is terminated. Changes required to accommodate delay or Work resulting from the discovery will be authorized in accordance with the General Conditions.
- 01520.3.11 OPERATIONS OUTSIDE OF THE PROJECT SITE
- In the event the CONTRACTOR chooses to use any site or means of obtaining resources beyond those provided as part of the Contract, the CONTRACTOR shall retain the services of a qualified, certified environmental consultant to produce a research design or plan for obtaining any and all necessary environmental clearances for such use. The CONTRACTOR shall provide the plan to the ENGINEER for review and approval, as required, following which the plan shall be implemented. The CONTRACTOR shall submit evidence of environmental clearances and compliance before commencing any activities within the extended use area. At a minimum, clearances will include those listed below. Additional clearances may be required as necessary.
- 01520.3.11.1 CULTURAL RESOURCES (Archeological and Historic) - Clearance may require consultation with the State Historic Preservation Office.

01520.3.11.2 THREATENED AND ENDANGERED SPECIES - Compliance may require written clearance from the U.S. Fish and Wildlife Service.

01520.3.11.3 FLOOD PLAINS – May require consultation with the Federal Emergency Management Agency (FEMA) or corresponding state agency.

01520.3.11.4 WETLANDS AND OTHER BODIES OF WATER – May require consultation with the Army Corps of ENGINEERS and/or appropriate state agency.

The CONTRACTOR is cautioned that obtaining environmental clearances can be costly and time consuming.

01520.4 METHOD OF MEASUREMENT

Not used.

01520.5 BASIS OF PAYMENT

Not used.

01560.1 DESCRIPTION

Construction staking procedures and responsibilities are broadly defined in the General Conditions and specific information is provided in this Section to define those procedures and responsibilities indicated in the General Conditions.

01560.2 QUALITY CONTROL

All construction staking, whether provided by the CONTRACTOR or the OWNER, will be supervised by a land surveyor registered in the state in which the Work is located. Surveys will be performed consistent with professional practices and precision generally conducted by surveyors licensed in that state. Complete, legible survey notes will be maintained by the surveyors which show the locations and measurements required to establish construction staking. Such documents shall also provide information to identify the project, location of survey, date of survey, land surveyor's name and registration number. Copies of the CONTRACTOR's survey documentation shall be made available to the OWNER upon request.

01560.3 OWNER RESPONSIBILITY**01560.3.1 FIELD LOCATION POINTS**

Unless otherwise indicated in the Contract Documents, the OWNER shall provide information on the Drawings and sufficient surveyed points in the field to locate all features and components of the Contract. Typically, field location points will be established to consist of the following:

01560.3.1.1 **PRESSURE LINES** - When pressure lines are located in established streets or areas with sufficient referencing features (curb, sidewalks, fence lines, etc.), no staking will be provided and location information shall be provided on the Drawings. When pressure lines are located in areas without sufficient referencing features, stakes will be set to establish the pipe centerline at 100-foot intervals. Where sloping of lines is critical (drain lines, etc.) cut stakes will be provided to indicate flow line elevation at beginning and ends of such lines.

01560.3.1.2 **SEWER AND OPEN CHANNEL FLOW LINES AND MANHOLES** - Manhole centerline locations will be shown with horizontal offset stakes and cut stakes to indicate the elevation of the flow line. In addition, cut stakes will be set to provide horizontal locations and grade 100-feet upstream on lines flowing into manholes.

01560.3.1.3 **TANKS** - Circular tank centerline location will be staked and a benchmark (grade) stake will be provided to establish floor top elevation. Exterior corners of rectangular tanks will be staked and a benchmark will be established for establishing floor top. Stakes locating rectangular tank corners will also be provided offset reference stakes.

01560.3.1.4 **BUILDINGS AND OTHER STRUCTURES** - Two reference points with offset reference stakes will be provided to establish horizontal location of one wall or the centerline. A benchmark (grade) stake will also be provided to establish vertical elevations of the building/structure/s components.

01560.3.1.5 **ROADWAYS** - In all roadway construction, offset stakes that identify location of the centerline of road will be set at intervals not to exceed 100-feet. When roadway construction requires specific grading, stakes will be set at the beginning points of cuts and fills with offset reference stakes. Hubs will be set to actual finished grades at the top edges of the subgrade and at each consecutive course of surfacing base. Hubs with offset reference stakes will be set on the centerline at the upstream and downstream lip of the flowline of all drainage pipes and structures. Staking intervals for roads with specified grading shall not exceed 100 feet in tangent sections and 50 feet in curved sections. When curbing and/or sidewalks are constructed along roadways, offset stakes with horizontal and vertical

referencing information will be set at intervals of not more than 50 feet. Bench marks for checking and establishing vertical elevations shall be set at intervals not more than 1000 feet apart.

01560.3.1.6 PONDS AND LAGOONS - Offset stakes which identify the centerline and cut/fill stakes with offset reference stakes will be set at intervals of not more than 100 feet as well as at the beginning and end of all curved sections of banks. At least one benchmark shall be provided for each cell of the pond for establishing and verifying vertical elevations.

01560.3.2 COST OF ERRORS

The OWNER shall be responsible for the accuracy of any staking, measurements, grades and alignment set by its own surveys. The OWNER shall cover costs resulting from staking errors attributable to the OWNER's survey.

01560.4 CONTRACTOR RESPONSIBILITY

01560.4.1 ESTABLISHMENT OF GRADES, ETC.

The CONTRACTOR shall establish any grades, elevations and distances required for its construction operation from the control staking provided by the OWNER and described above. The CONTRACTOR shall advise the OWNER of anticipated conditions which will affect location of offset stakes and protect the control staking from its construction operation. Where control staking has been damaged or obliterated by the CONTRACTOR's operation, replacement of the staking shall be made in accordance with the provisions of the General Conditions.

01560.4.2 ERRORS IN CONSTRUCTION STAKING

When the CONTRACTOR observes discrepancies or errors in the control staking, such problems shall immediately be brought to the attention of the ENGINEER, and the ENGINEER shall take corrective action as necessary to resolve the problem.

01560.4.3 ACCURACY IN CONTRACTOR SURVEYING

The CONTRACTOR shall be responsible for the accuracy of any staking, measurements, grades, and alignments set by its own surveys. Any costs resulting from staking errors attributable to the CONTRACTOR shall be borne by the CONTRACTOR. The ENGINEER reserves the discretionary right to check the CONTRACTOR's staking, grades and measurements randomly at any time. When such checking is to be exercised, the ENGINEER will notify the CONTRACTOR of the location and the time at which the checking will commence. The CONTRACTOR shall then stop any respective part of the Work in progress until the ENGINEER has notified the CONTRACTOR that the checking has been completed and the Work has been found to be in accordance with requirements of the Contract Documents.

01580.1 DESCRIPTION

In general, the CONTRACTOR is responsible for providing and maintaining access to the Work, handling and storing of materials and equipment, safety and security within the Work site, and coordination and cooperation with the OWNER, its representatives, governing authorities and other contractors working for the OWNER in accordance with the provisions of the General Conditions. This section contains specific requirements which apply to these responsibilities.

01580.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02005 – Traffic Control

01580.1.2 SUBMITTALS

Not used.

01580.1.3 DEFINITIONS

Not used.

01580.2 WORK SITE ACCESS**01580.2.1 INVESTIGATION OF WORK SITE AREA**

The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting ingress and egress to the site of the work.

01580.2.2 HAUL ROADS

It shall be the CONTRACTOR's responsibility to construct and maintain any new haul roads required for its construction operations.

01580.2.3 USE OF PUBLIC STREETS AND ALLEYWAYS

Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the Work, unless shown otherwise in the Contract Documents.

01580.2.4 CLOSURE OF PUBLIC ROADWAYS

No street, road, or highway shall be closed to the public without first obtaining permission from the proper governmental authorities and the ENGINEER. Where excavation is being performed in streets or highways, one lane in each direction shall be kept open to traffic at all times, unless otherwise authorized by the Contract Documents or the ENGINEER. Toe boards, or other measures, may be required by the ENGINEER to retain excavated material when deemed necessary.

01580.2.5 INTERFERENCE WITH UTILITIES

The CONTRACTOR shall so conduct operations as not to interfere unnecessarily with the infrastructure of utility companies or other agencies in such streets, alleyways, or parking areas.

01580.3 PUBLIC SAFETY AND ACCESS

Fire hydrants, approaches to fire stations, police stations and hospitals on or adjacent to the Work shall be kept accessible at all times. Appropriate measures shall be taken by the CONTRACTOR, to assure the use of sidewalks, and the proper functioning of all gutters, sewer inlets, water mains, drainage facilities and other infrastructure.

The CONTRACTOR's responsibility for Work safety or liability for Work site accidents is not lessened by the presence of the ENGINEER or his or another inspector performing monitoring of Work site safety conditions.

See also Section 02005 – Traffic Control.

01580.4 CONTRACTOR'S USE OF THE WORK SITE

The CONTRACTOR's use of the Work site shall be limited to its construction operations. Written approval by the ENGINEER will be required for any other use of the site, such as material and equipment storage, personnel vehicle parking, on-site fabrication facilities and field office.

01580.5 OFF-SITE STORAGE

The CONTRACTOR shall make arrangements for, bear any use costs associated with, and obtain written permission from the ENGINEER prior to using any off-site storage or shop areas or facilities determined necessary for execution of the Work. Storage facilities shall be equipped with fences and/or lockable entries that will prevent entry by unauthorized parties. Before off-site storage facilities are placed in use, the CONTRACTOR shall provided the OWNER keys or combinations to locking devices used to secure the facility.

01580.6 COOPERATION WITH OTHER CONTRACTORS

Prior to authorizing other contractors to work on or adjacent to the Work site, the OWNER shall notify the CONTRACTOR in writing and provide the name and address of the CONTRACTOR, the name of its supervisor, a description of the work to be performed, and a schedule which shows the dates and planned segments of the work to be completed by the other contractor. In the event that conflicts or interferences occur between the CONTRACTOR and the other contractor's operation, the ENGINEER shall be notified immediately. The ENGINEER shall then take appropriate action needed to resolve the problem.

DIVISION 2

SITWORK



02000.1 DESCRIPTION

This section describes various tasks associated with project execution and close out. Mobilization shall include: preparatory work and materials necessary for obtaining clearances for the Work; moving personnel, equipment, supplies and incidentals to and from the Project Site; quality control; clean-up; temporary utilities and quarters; permits, bonds and insurance; dust abatement, storm water control, and noise abatement; waste and rubbish disposal and control; sanitation; and project close-out operations.

02000.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01200 - Contract Closeout
Section 01510 - Protection of Existing Property
Section 01520 - Environmental Controls
Section 02005 - Traffic Control

02000.1.2 SUBMITTALS

02000.1.2.1 VISUAL RECORDS - The CONTRACTOR shall furnish at least one copy of all visual records, as described below in 02000.3.2, to the OWNER. If the OWNER has more exacting requirements for visual records, those requirements shall be detailed in the Special Provisions to these Specifications.

02000.1.2.2 SERVICE CONNECTION LOCATION AND DOCUMENTATION - The CONTRACTOR shall deliver all signed tie-sheets (see 02000.3.3 below) to the ENGINEER not less than forty-eight hours prior to when the service connection is to be installed.

02000.1.3 DEFINITIONS

Sign - A complete assembly including panel and posts, with fasteners, installed at designated locations.

DVD Record - Photography on DVDs of areas potentially liable for disturbance as a result of the Work required by this Contract.

Service Connection Interview & Documentation - Interviews with potential system users and the documentation of location data for service connections to the respective property from utility lines being installed under this Contract.

Tie Sheets - Forms provided by the ENGINEER for use in documenting the location of service connection/s of system users.

Service Connection - Piping extending from the main utility line to the property line, or designated connecting point, of any user of the system.

02000.2 MATERIALS**02000.2.1 SIGN PANELS**

5/8-inch thick (A or B) exterior grade plywood sheets with best quality exterior enamel paint for face painting and lettering, fastened to posts with at least four 1/2-inch galvanized bolts.

02000.2.2 POSTS

4x4 Cedar or treated Pine commercial fence posts at least eight-feet long or as shown on the Drawings.

02000.2.3 VISUAL RECORD

Records shall be made on professional quality, standard DVD format recording. DVD's shall be provided with protective covers and shall be labeled to indicate the area covered by the photography.

02000.3 CONSTRUCTION REQUIREMENTS**02000.3.1 PROJECT SIGN**

The CONTRACTOR shall provide project signs, which includes furnishing all materials and labor to fabricate, deliver, install and maintain any and all project identification signs as detailed on Drawings and at location(s) shown thereon.

02000.3.2 VISUAL RECORDS

Prior to any disturbance of the area, the CONTRACTOR shall produce a DVD photography of all areas, including but not limited to right-of-ways, streets and roadways, haul-roads and access routes, storage areas, construction sites, and buildings or structures, which will be, or may be, affected by the Work. Such photography will be of a quality to allow accurate determination of location, size, and condition of existing features and improvements taken prior to any occupancy or execution of Work by the CONTRACTOR.

02000.3.3 SERVICE CONNECTION LOCATION AND DOCUMENTATION

Unless called for differently, the CONTRACTOR shall contact and interview the owners of all properties indicated on the Drawings and obtain from them sufficient information for location of workable service connections for each property. The CONTRACTOR shall document those locations on the tie sheets and obtain a confirmation signature from the connection owner.

02000.4 METHOD OF MEASUREMENT**02000.4.1 MOBILIZATION**

Mobilization shall be measured by the lump sum.

02000.4.2 PROJECT SIGN

Measurement for project signs shall be made by counting each sign installed and accepted.

02000.4.3 VISUAL RECORDS

Pre-Construction Photography shall be measured by the lump sum.

02000.4.4 SERVICE CONNECTION DOCUMENTATION

Service Connection Documentation shall be measured by the lump sum.

02000.5 BASIS OF PAYMENT

02000.5.1 The accepted quantity(s) shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Mobilization	Lump Sum
Project Sign	Each
Pre-Construction DVD	Lump Sum
Service Connection Documentation	Lump Sum

02000.5.2 **PAYMENT SCHEDULE**

The amount bid or identified in a schedule of values for Mobilization shall not exceed 10% of the total contract bid amount. The following payment schedule percentages shall be based on amount bid or identified in a schedule of values for Mobilization up to a maximum of 10% of the total contract bid. Any portion of the mobilization bid amount which exceeds 10% of the total contract bid amount, will be paid to the CONTRACTOR after final acceptance of the Work, with the last mobilization payment. (See “overage amount” in the payment schedule table below).

Partial payments for Mobilization will be made in accordance with the payment schedule table below.

MOBILIZATION PAYMENT SCHEDULE

Payment	Amount	When Paid
1 ST	25% of mobilization	With first partial payment after 3% of the original contract amount earned by the CONTRACTOR.
2 ND	25% of mobilization	When amount earned by CONTRACTOR is 10% of the original contract price.
3 RD	25% of mobilization	When amount earned by CONTRACTOR is 50% of the original contract price.
4 TH (last)	25% of mobilization + “overage amount”	When project is complete and accepted.

02005.1 DESCRIPTION

This section covers furnishing and maintaining all traffic control devices, flaggers and pilot vehicles necessary for protection of the Work, the workers and the traveling public in accordance with these Contract Documents. The requirements of this section are not intended to supersede, but shall supplement, the provisions contained in the "Manual of Uniform Traffic Control Devices" issued by the U.S. Department of Transportation, and any other applicable state or local traffic control regulations.

02005.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01580 – Work Site Management
Section 02206 – Access Roads and Temporary Use of Roads

02005.1.2 SUBMITTALS

The CONTRACTOR, upon request of the OWNER or ENGINEER, shall submit detailed traffic control plans for specific areas of the Work.

02005.1.3 DEFINITIONS

Traffic Control Devices - All temporary traffic control and warning devices required to warn traffic of, and to guide it through, construction areas as required under this Contract, including, but not limited to: portable cones and barricades, signs, channeling devices, paint striping, lighting devices, flags, etc.

Flaggers - Qualified and alert persons equipped with safety warning devices who direct traffic through construction areas.

Traffic Lane - Ten (10) feet of clear street width with a safe motor vehicle speed of twenty-five (25) miles per hour.

Pilot Car - Any designated and properly marked vehicle used for leading groups of vehicular traffic through construction areas.

02005.2 MATERIALS

Not Used.

02005.3 CONSTRUCTION REQUIREMENTS**02005.3.1 COORDINATION OF WORK AND TRAFFIC CONTROL**

The CONTRACTOR shall endeavor to organize its work force in such a manner as to minimize the closure of public streets and roadways within the Work site. If conditions justify, the ENGINEER may direct the CONTRACTOR to conduct Work in specific areas and/or to specific tasks to avoid closure or interference with traffic on public streets and roadways.

02005.3.2 CLOSURE OF PUBLIC THOROUGHFARES

The CONTRACTOR shall not close any public street or roadway without prior approval by the ENGINEER. When closure is necessary, and approved, the street or roadway shall only be closed to through traffic and not to local traffic. Closure may extend for one city block only, or 700 feet,

whichever is less. Closure of streets and roadways shall be made with barricades meeting State DOT standards. Traffic shall be kept open on streets and roadways where no detour is possible.

02005.3.3 MAINTENANCE OF EXISTING SIGNS

Existing traffic signs other than stop, yield, and street name signs shall be maintained by the CONTRACTOR until such time as construction renders them obsolete. At that time the CONTRACTOR shall remove signs and posts without damage and deliver them as directed by the ENGINEER.

02005.3.4 PROTECTION OF WORK AND TRAFFIC

All obstructions and excavations, within traveled streets and roadways, shall be protected with traffic control devices meeting State DOT standards. Traffic control devices, placed within streets and roadways, shall be illuminated at night, and such illumination shall function from sunset to sunrise. Local jurisdiction may require traffic control measures greater than those of State DOT standards, in which case the CONTRACTOR shall comply with such requirements.

Whenever the ENGINEER finds traffic control conditions at the Work site to be inadequate to assure public safety, or the CONTRACTOR's protective facilities to be inadequate, the ENGINEER may require the CONTRACTOR to provide the additional necessary facilities or services. The CONTRACTOR shall bear the cost of the additional protection.

See also Subsection 01580.3.

02005.4 METHOD OF MEASUREMENT**02005.4.1 TRAFFIC CONTROL AS LUMP SUM**

If traffic control appears as a separate item in the Bid Schedule, it shall be measured as a lump sum item. Therefore, with the possible exception of the items mentioned in the following two paragraphs, no separate measurement will be made for furnishing and maintaining traffic control devices, personnel, or any vehicles or other equipment used for traffic control.

02005.4.2 FLAGGING

When flagging is listed separately in the Bid Schedule, the work of flag persons will be measured by counting the number of hours put in by each separate flag person. This measurement shall include the time and/or mileage for any vehicle or other equipment required for performing the flagging work.

02005.4.3 PILOT VEHICLE

When a requirement for the use of pilot vehicles is called for separately in the Bid Schedule, that use will be measured by counting the number of hours each separate vehicle is in actual operation piloting or otherwise directing traffic.

02005.5 BASIS OF PAYMENT

02005.5.1 Unless provided for in the Contract Documents, the cost of all traffic control, including flagman, barricades, pilot cars and other devices, shall be included in the Contract Price and no separate measurement and payment will be provided.

02005.5.2 When provided in the Bid Schedule, the generally accepted quantities for traffic control shall be:

PAYMENT ITEM	UNIT
Traffic Control	Lump Sum
Flaggers	Hours
Pilot Vehicles	Hours

02015.1 DESCRIPTION

This section covers the removal of vegetation, debris, and other obstacles from the defined rights-of-way and limits of the project area and/or construction work site.

02015.1.2 RELATED WORK

Section 01510 - Protection of Existing Improvements
Section 02200 - Trench Excavation and Backfill
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02015.1.3 DEFINITIONS

Clearing - consists of removal and disposal of trees, stumps, logs, limbs, sticks, vegetation, rubbish, debris and other material on the natural ground surface.

Grubbing - consists of removing and disposing of roots (one-inch and larger diameter), tree stumps, buried logs, debris, and other underground obstructions.

02015.2 MATERIALS

Not used

02015.3 CONSTRUCTION REQUIREMENTS

Clear, grub, remove and dispose of all trees, vegetation and debris within the staked limits of the roadways, trenches, channels, easements, embankments, structures, and other designated areas. Do not injure or damage trees, shrubs, or other vegetation and objects to remain intact as designated by the ENGINEER or the OWNER. Such items are to be fully protected from injury at the CONTRACTOR's expense.

02015.3.1 CLEARING

Areas within the limits of excavation and embankment slope stakes shall be cleared.

Tree branches extending over the area to be cleared and which hang within 12 feet of the ground surface shall be cut off in a neat and workmanlike manner. When such branch removal is necessary, the CONTRACTOR shall remove other adjacent branches on the tree under the direction of the ENGINEER so as to present a balanced appearance. Scars resulting from the removal of branches shall be treated with a heavy coat of approved tree sealant.

02015.3.2 GRUBBING

Grub all areas within the limits described as follows:

02015.3.2.1 FOR CONSTRUCTION OF ROADWAYS - Grub the area between the limits of the excavation and embankment slope stakes to a depth of two (2) feet below natural ground level to remove all stumps, roots, buried logs and other underground debris. However, when the roadway embankment already is two feet or more above the natural ground level, stumps cut less than 6 inches above natural ground, together with roots and other non-perishable obstructions, may remain in place.

02015.3.2.2 FOR CONSTRUCTION OF PONDS OR LAGOONS AND STRUCTURES - completely grub the pond area within the boundaries of the dikes or structures to a depth of two (2) feet and remove all stumps, roots, buried logs and other underground debris. Grubbing of this area shall include removal of the top 6-inches of organic laden topsoil and stockpiling it for later distribution over areas shown in the Contract Documents or directed by the ENGINEER.

02015.3.3 BACKFILLING

All stump holes, cuts, depressions and other holes resulting from clearing and grubbing operations within areas designated to receive pipelines, structures, or embankments shall be backfilled and compacted to the density of the surrounding ground.

02015.3.4 DISPOSAL

The CONTRACTOR shall dispose of all materials resulting from clearing and grubbing operations as required in the Contract Documents and in accordance with Section 01520 of these Specifications.

02015.3.5 MARKERS, MONUMENTS AND DATA POINTS

Land monuments, property markers or official datum points shall be protected until their removal is approved. When movement of monuments or markers is deemed necessary and approved by the ENGINEER, all such monuments or markers shall be carefully referenced for re-establishment before removing.

02015.4 METHOD OF MEASUREMENT

02015.4.1 SEPARATE PAYMENT

Measurement for "Clear and Grub" shall be made either as lump sum or by counting the number of acres, to the nearest tenth (10th), of area actually cleared and grubbed within the limits shown on the Drawings or as directed and approved by the ENGINEER. For areas where ponds or lagoons are to be constructed, this measurement shall include the removal and stockpiling of the first six (6) inches of topsoil in addition to grubbing to the required depths.

02015.4.2 NO MEASUREMENT

02015.4.2.1 NO PAY ITEM FOR CLEAR & GRUB - When the Bid Schedule does not contain a pay item for "Clear and Grub", then that work will be considered incidental to other Work items which require clearing and grubbing and no separate measurement shall be made.

02015.4.2.2 ROADWAY EXCAVATION and/or BORROW - Material used for filling depressions will be measured separately only when "Roadway Excavation" and/or "Borrow" appear as separate pay items on the Bid Schedule. Measurement will be made by counting the number of cubic yards of material moved and placed as designated on the Drawings or as directed and approved by the ENGINEER. If "Roadway Excavation" or "Borrow" are not included in the Bid Schedule, material used for filling depressions will not be measured separately, but will be considered incidental to the Work.

02015.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

PAYMENT ITEM	UNIT
Clear and Grub	Lump Sum
Clear and Grub	10 th of Acre

02020.1 DESCRIPTION

Furnish and provide labor and equipment for investigation of existing miscellaneous pipelines, wires or cables, and other miscellaneous sub-surface features as required by the ENGINEER.

02020.1.1 RELATED WORK

Section 01510 - Protection of Existing Improvements

02020.1.2 SUBMITTALS

Not used.

02020.1.3 DEFINITIONS

Not used.

02020.2 MATERIALS

The CONTRACTOR shall provide a backhoe and qualified operator; laborer with hand shovel; appropriate fuel and lubricants, necessary equipment servicing materials; and appropriate equipment for transporting the backhoe to perform the investigation. The backhoe shall be a rubber tired CASE 580 backhoe, or an approved unit of equivalent or greater size and capacity, having accumulated not more than 5,000 hours operating time.

02020.3 CONSTRUCTION REQUIREMENTS**02020.3.1 EXPOSURE BY EXCAVATION**

When directed by the ENGINEER, the CONTRACTOR shall excavate and expose miscellaneous pipelines, structural features, soil materials and other underground features which may be present at the work site. The location and extent of exposure shall be determined on site by the ENGINEER. Designation of such areas shall be made in writing, usually in the form of a Work Order, by the ENGINEER.

02020.3.2 REPLACEMENT OF EXCAVATED MATERIALS

Work required hereunder shall include replacement of excavated materials sufficiently to restore the site to a safe condition as determined by the ENGINEER. Full restoration of materials such as pavement, concrete slabwork, sod, etc., in the investigated area will be accomplished in accordance with the Contract Documents and as directed by the ENGINEER.

02020.4 METHOD OF MEASUREMENT**02020.4.1 MEASUREMENT BY HOURS OF WORK**

Measurement of subsurface investigation shall be made by counting the actual number of hours of work completed by the machine and operator to investigate miscellaneous underground features as required by the ENGINEER. No allowance of time will be made for transporting the backhoe to and from the job site when the backhoe is located on the site of the Contract.

02020.4.2 MEASUREMENT FOR OTHER ITEMS OF WORK

When restoration of the excavated area requires provision of pavement, concrete slabwork, sod, etc., separate measurement will be made for those materials in accordance with the respective requirement(s) for measurement of that item in the Contract Documents.

02020.5 BASIS OF PAYMENT

The accepted quantity of work will be paid for at the contract unit price of:

PAYMENT ITEM	UNIT
Subsurface Investigation	Hour

When provision of designated materials is required for restoration of the excavation, payment for such materials shall be made in accordance with the respective provisions of the Contract documents.

02105.1 DESCRIPTION

This section covers obtaining permission, permits, clearances, etc.; as necessary to develop source(s), purchasing or manufacturing, loading, hauling, placing and compacting earthwork materials described herein, as shown on the Drawings and/or required by these Specifications.

02105.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill

02105.1.2 SUBMITTALS

When the Bid Schedule indicates quantities of materials described in this section in excess of 50 cubic yards or 50 tons, or when requested otherwise by the ENGINEER, the CONTRACTOR shall provide test results from a certified independent laboratory which has sampled and performed the prescribed test(s) for those materials.

02105.1.3 DEFINITIONS

Granular Material - Material for which the sum of plasticity index (AASHTO T-90) and the percent of material passing a No. 200 sieve (AASHTO T-27) shall not exceed 23.

Silt - Material which passes the No. 200 (AASHTO T-11) sieve and has a plasticity index not greater than 10.

Clay - Material which passes the No. 200 sieve and has a plasticity index greater than 10.

Bedding - Materials placed immediately around and adjacent to pipe installed in trenches.

Borrow - Material obtained from a source away from the site on which installed and/or excavated and used to supplement insufficient quantities of material required.

02105.2 MATERIALS**02105.2.1 ON-SITE TRENCH OR STRUCTURAL BACKFILL**

On-site trench or structural backfill consists of material excavated during trenching or foundation excavation which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum particle size not greater than 6 inches. Material may be required to be processed or transported along the excavation.

02105.2.2 IMPORTED TRENCH OR STRUCTURAL BACKFILL

Imported trench or structural backfill consists of granular material obtained from sources indicated on the Drawings, designated in the Special Provisions or approved by the ENGINEER. Borrow materials shall be free of cinders, ashes, wood, vegetative matter, frozen or other deleterious matter with a maximum particle size not greater than 6 inches. Pit Run Borrow may be used as backfill in trenches, excavations for structures, in roadway subgrades, or as otherwise shown on the Plans or called for by the ENGINEER. Material may be processed or may be pit run.

02105.2.3 ON-SITE PIPE BEDDING

On-site pipe bedding consists of material excavated during the trenching operation which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum

particle size not greater than that shown below in Table 1. Material may be required to be processed or transported along the trenching operation.

02105.2.4 IMPORTED PIPE BEDDING

Imported pipe bedding consists of granular material excavated from an approved borrow source which is free of cinders, ashes, wood, vegetation, frozen or other deleterious material or rocks with a maximum particle size not greater than that shown in Table 1 below. Material may be processed or may be pit run.

Table 1 - MAXIMUM PARTICLE SIZE FOR PIPE BEDDING

Pipe	Size
Corrugated Metal and Welded Steel	1"
Polyethylene, Galvanized Steel and PVC	3/4" in Utah or 1" in other states
Ductile Iron, Cast Iron, Concrete, and HDPE	2"

02105.2.5 SAND

Sand shall be graded granular material which passes a 3/8-inch sieve, with not more than 10 percent passing the No. 200 sieve (AASHTO T-27) and free from cinders, ashes, wood, vegetation, frozen or other deleterious material.

02105.2.6 UNTREATED BASE COURSE

Untreated base course consists of processed natural gravel and crushed rock with an approved soil binder without any deleterious materials, tested in accordance with AASHTO T-27 and T-11 which meets the gradation requirements in Table 2 below.

Table 2 - PARTICLE SIZE FOR UNTREATED BASE COURSE

Sieve Size	Percent Passing
1-inch	100
1/2-inch	70-90
#4	40-60
#16	20-40
#200	5-12

02105.2.7 BITUMINOUS SURFACING

Plant mix bituminous material, with maximum particle size not greater than 3/4-inch, meeting the requirements of Section 02511 of these Specifications.

02105.2.8 DRAIN GRAVEL

Drain gravel consists of washed natural gravel or crushed rock, with a maximum particle size of 1-inch, with not more than 40 percent passing the No. 4 sieve, with 100 percent being retained on the No. 10 sieve, and without any deleterious material.

02105.2.9 RIPRAP

Riprap consists of durable, angular, sound and hard field or quarry stones free from cracks and structural defects. Source of supply shall be approved by the ENGINEER. Fifty percent of the stones shall be of sizes between one-half and two-thirds of the riprap layer thickness shown on the

Drawings. Not more than 10-percent of the stones by weight shall be of a size less than one-tenth of the riprap layer thickness shown on the Drawings and the specific gravity of the stones must range between 2.5 and 2.82 (AASHTO T-85). Durability of the stones shall be in excess of 40 percent (AASHTO T-210).

02105.2.10 SUBGRADE GRANULAR FILL

Subgrade granular fill consists of well graded granular soils with a maximum of 50 percent passing the No. 4 sieve and a maximum of 20 percent passing the No. 200 sieve and no materials greater than 4-inches in diameter.

02105.3 CONSTRUCTION REQUIREMENTS

02105.3.1 LOCAL GOVERNMENT SPECIFICATIONS

Differences may exist between the requirements of these Specifications for sitework materials such as backfill, bedding, untreated base course and bituminous surface course, and those of local government entities. Such differences may affect Contract prices; therefore, when Contract Work falls within the boundaries of any local government, the CONTRACTOR shall make himself aware of that entity's specifications for those materials. If differences exist between those specifications and these, unless otherwise approved by the ENGINEER, the more stringent ones shall apply.

02105.3.2 BORROW AND DISPOSAL SITES

The CONTRACTOR shall, at its own expense, secure all necessary access and borrow sites for acquisition or removal and to dispose of excess backfill or waste materials, unless otherwise shown on the Drawings.

02105.3.3 ON-SITE MATERIALS

Unless otherwise shown on the Drawings or directed by the ENGINEER, on-site pipe bedding and trench backfill will be used for installation of all pipe. In areas where suitable on-site material is not available, other material, which meets these Specifications, will be used when shown on the Drawings, provided for in these Contract Documents or approved by the ENGINEER.

02105.3.4 SCALES

When ton weight is to be used to determine quantities of earthwork materials used, the CONTRACTOR shall provide his own scales or access to other scales at his own cost. Scales shall be certified accurate. Include certification in submittals.

02105.4 METHOD OF MEASUREMENT

02105.4.1 NO MEASUREMENT

On-Site Pipe Bedding and On-site Trench or Structural Backfill will be considered part of the items for piping or excavation associated with structures included in the Bid Schedule and no separate measurement for these materials will be made.

02105.4.2 SEPARATE MEASUREMENT

02105.4.2.1 IMPORTED MATERIALS – Quantities of imported pipe bedding and imported trench or structural backfill shall be determined by measuring the lineal feet (lineal feet of trench requiring

imported materials) of imported material in place and accepted. This measurement shall include furnishing all necessary materials and equipment, labor, hauling, placement, compaction, and testing to produce an acceptable trench fill.

No allowance will be made for bedding and backfill materials required to fill voids caused by trenching operations, which exceed the dimensions shown on the Drawings.

02105.4.2.2 SAND – Quantities of sand shall be determined in cubic yards in place, calculated by multiplying the measured length of trench by the measured depth of bedding by the pay width shown on the Drawings, or as directed by the ENGINEER in the field.

No allowance will be made for materials required to fill voids caused by trenching operations, which exceed the dimensions shown on the Drawings.

02105.4.2.3 UNTREATED BASE COURSE - Quantities of untreated base course shall be determined in cubic yards in place, calculated by multiplying the measured length by neat line dimension shown on the drawings. If no neat lines are shown on the Drawings, then the cubic yard calculations shall be determined by actual measurements in the field in place.

02105.4.2.4 BITUMINOUS SURFACING – Quantities of the respective compacted thickness of bituminous surfacing shall be determined in square yards by multiplying the length of material in place and accepted by the pay width shown on the Drawings, or as directed by the ENGINEER in the field.

02105.4.2.5 DRAIN GRAVEL - Quantities of drain gravel shall be determined in cubic yards calculated by multiplying the measured length by the measured depth of bedding in place by the pay width shown on the Drawings, or as directed by the ENGINEER in the field.

02105.4.2.6 RIPRAP - Quantities of riprap shall be determined in cubic yards by multiplying the measured length by the measured breadth by the measured average depth of material in place and accepted.

02105.4.2.7 SUBGRADE GRANULAR FILL - Quantities of subgrade granular fill shall be determined in cubic yards by multiplying the measured length by the measured breadth by the measured depth of material in place and accepted.

02105.5 BASIS OF PAYMENT

The accepted quantity shall be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Imported Trench or Structural Backfill	Lineal Foot
Imported Pipe Bedding	Lineal Foot
Sand	Cubic Yard
Untreated Base Course	Cubic Yard
Bituminous Surfacing (Thickness)	Square Yard
Drain Gravel	Cubic Yard
Riprap	Cubic Yard
Subgrade Granular Fill	Cubic Yard

02200.1 DESCRIPTION

This section covers furnishing of equipment, labor, and materials to clear, excavate, backfill and compact trenches for utilities. Excavation and backfill for piping appurtenances such as manholes, inlets, transition structures, junction structures, vaults, thrust blocks, valve boxes, catch basins, etc., shall be included, as also shall be restoration of the disturbed ground surface in accordance with the Specifications.

02200.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02005 - Traffic Control
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02204 - Water for Construction
Section 02208 - Flowable Backfill
Section 02222 - Water Pipe Installation
Section 02224 - Sewer Pipe and Manhole Installation
Section 02315 - Boring and Jacking
Section 02320 - Pipe Encasement
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02200.1.2 SUBMITTALS

02200.1.2.1 MOISTURE DENSITY TESTING AND GRADATION DETERMINATIONS - A documentation system shall be maintained by the CONTRACTOR to record results from all moisture/density testing and gradation determinations. Records of these tests shall show the following information as a minimum:

- Date of test.
- Type of test.
- Name of person performing test.
- Location of sample taken.
- Results of test and comparison with specified value required for compliance.

Upon completion of each gradation test or moisture/density test, a copy of the record for the respective test shall be delivered to the ENGINEER within one (1) working day following the completion.

02200.1.2.2 COMPLIANCE TESTING - Documentation shall also be made, in field diaries, of all compliance tests performed by the CONTRACTOR. Documentation shall be made available to the ENGINEER upon request.

02200.1.3 DEFINITIONS

Trench Width - Shall not be more than 18 inches greater than the outside diameter of the pipe being installed at a point 12 inches above the top of the pipe unless otherwise shown on the Drawings. The width of the trench above that level shall be the minimum width required for safe working conditions, sheeting, bracing and for proper installation of the work.

Trench Grade - The vertical elevation of the flowline of the pipe being installed in the trench.

Open Trench - Shall include trench sections which have been excavated and are awaiting completion of pipe installation, backfill, compaction or installation of a temporary surface.

Surface Restoration - Shall include the Work required to restore the ground surface disturbed for trench excavation. Replacement of road surfacing, planting and landscaping removed for trench excavation, will not be considered as trench excavation and backfilling.

Consolidated Backfill - A condition of backfilling for which a specified compaction density is required. Maximum lift, prior to compaction, for consolidated backfill shall be 8 inches unless otherwise approved by the ENGINEER.

Unconsolidated Backfill - A condition of backfilling for which no compaction density is specified and the required compaction effort is layer placing and then compacting by wheel rolling or use of compacting equipment. Lifts of up to 24 inches are allowed for unconsolidated backfill.

Unclassified Excavation - A determination for excavating whereby no consideration will be given to different kinds of materials that are encountered.

02200.2 MATERIALS

Not used.

02200.3 CONSTRUCTION REQUIREMENTS**02200.3.1 PERMITS**

For work which is to take place within state and/or federal road and highway rights-of-way, the CONTRACTOR shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

All work in any city, town or county public right-of-way will also require an approved excavation permit from that entity. The CONTRACTOR shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

02200.3.2 CLEARING AND GRUBBING

On areas outside of established roadways, the area to be disturbed by the trenching operation shall be cleared and grubbed in accordance with Section 02015 prior to beginning the trenching operation.

02200.3.3 EXCAVATION

02200.3.3.1 UNCLASSIFIED EXCAVATION - All excavation for this project shall be unclassified excavation, unless otherwise determined by the ENGINEER.

02200.3.3.2 STAKING - Location staking of piping will be provided by the OWNER in accordance with the provisions of Section 01560 unless indicated otherwise in the Specifications.

02200.3.3.3 EXPOSURE OF UNDERGROUND FEATURES - Before any trench excavation is started, the CONTRACTOR shall locate and expose all existing underground utilities, structures, etc., which may interfere with, or conflict with, the trench being excavated. In case of conflicts, the CONTRACTOR shall make adjustments in the location of the excavation at the direction of the ENGINEER. Such adjustments shall be made at no additional cost to the OWNER.

02200.3.3.4 The CONTRACTOR shall perform all excavation to the depth specified in the Drawings and/or as required to accomplish the Work. During the excavation operations, excavated materials which are suitable for use as backfill for trenches or around structures, shall be piled separately at sufficient distance from the edge of the excavation to be out of the way of equipment and to

prevent slides and cave-ins from embankment overloading. All excavated materials not suitable for, or not required for, fill or backfill shall be separated and removed promptly from the site of the Work and disposed in an approved site in accordance with Section 01520.

02200.3.3.5 PUBLIC TRAVEL - Materials excavated within roadways, regardless of their disposition, shall be piled in such manner that will cause the minimum of inconvenience to public travel and always allow for emergency vehicle passage.

02200.3.3.6 OPEN TRENCH - At no time shall the CONTRACTOR allow more than 500 cumulative feet of trench to be open for the overall project, unless otherwise approved by the ENGINEER.

02200.3.3.7 SHORING - Shoring and/or trench boxes shall be used wherever needed to protect workers and adjacent structures and property of the Work in accordance with OSHA requirements. The arrangement of bracing of shoring shall not be set so as to stress any portion of completed work.

02200.3.3.8 BARRICADING OPEN WORK - Excavations left open at the end of the work day shall be surrounded by barricades and warning tape.

02200.3.4 EXCAVATION IN ROCK

02200.3.4.1 SOLID ROCK EXCAVATION – If:

- The Specifications contain provisions for “Solid Rock Excavation”, and
- If rock has been encountered in the excavation, and
- If the CONTRACTOR has made three attempts to remove the rock using a "Kelly" or similar type ripper having not less than 235 fly wheel horsepower, then

the excavation of such material will be considered as "solid rock excavation".

02200.3.4.2 BLASTING - When blasting is deemed necessary for rock removal, the CONTRACTOR shall comply with all applicable State and Local laws, ordinances, and provisions for blasting safety and obtain written approval from the ENGINEER prior to starting of drilling and/or blasting operations.

In all cases, blasting shall be performed by experienced, qualified blasters. The CONTRACTOR is responsible for any and all damage caused by blasting, and blasting will not be allowed within 15 feet of any existing structures.

02200.3.5 OVER-EXCAVATION

02200.3.5.1 UNAUTHORIZED OVER-EXCAVATION - Care shall be taken to not excavate below the depth required by the Drawings. Any unauthorized over-excavation shall be refilled and compacted with material meeting the requirements of Section 02105 and approved for use by the ENGINEER at the expense of CONTRACTOR.

02200.3.5.2 ROCK - Whenever rock is encountered in the trench bottom, the trench shall be over-excavated a minimum of 6 inches below the design elevation of the bottom of the pipe. The over-excavated portion of the trench shall be filled with approved bedding material and the bedding compacted, all at the expense of the CONTRACTOR, unless otherwise approved by the ENGINEER and the OWNER.

02200.3.5.3 UNSTABLE NATIVE FORMATIONS - The CONTRACTOR shall notify the ENGINEER if soft, spongy, or otherwise unstable native formations, that are not suitable for structure or pipeline foundations, are encountered in excavations. In the event the ENGINEER determines that the existing foundation materials are unacceptable, the CONTRACTOR will be directed to over-

excavate, remove and replace the unsuitable soil materials. The over-excavation shall be backfilled with approved select materials and compacted in accordance with the requirements described herein. Such situation will be considered as a changed condition and the CONTRACTOR will be compensated in accordance with Subsection 00700.13 of the General Conditions.

02200.3.6 PIPELINE ACCESSORY INSTALLATION

02200.3.6.1 EXCAVATION FOR ACCESSORIES - The CONTRACTOR may excavate to place the sides of manholes, vaults, valve boxes, inlet structures, catch basins or other accessory structures directly against the excavated surface, provided that the faces of the excavation are firm and unyielding and are at all points outside the structure lines shown on the Plans. If the native material is such that it will not stand without sloughing, the CONTRACTOR shall over-excavate to place the structure and this over-excavation shall be backfilled and compacted, using the same material required for the adjoining pipeline trench.

02200.3.6.2 ACCESSORY SUPPORT - To prevent displacement of valve boxes and other accessory structures, trench backfill shall be compacted to at least 95% of maximum density as determined by AASHTO T-99 for 6 feet along the trench on each side of the box or structure.

02200.3.7 TRENCH BOTTOM PREPARATION

The bottom of the trench shall be accurately graded to provide uniform bearing and support for each section of the pipe. Bell or coupling holes shall be made in accordance with the recommendations of the pipe manufacturer after the trench bottom has been graded. Such depressions shall be of sufficient width to provide clearance for connecting and/or bolting. Holes for depressions shall be excavated only as necessary to permit proper joining of pipe sections.

02200.3.8 SURFACE IMPROVEMENTS

When surface improvements must be removed, or are damaged or disturbed by the Work, their removal and restoration shall be accomplished by the CONTRACTOR in accordance with Sections 01510 and 02500 of these Specifications.

02200.3.9 PROTECTION OF EXISTING UTILITIES

The CONTRACTOR shall protect all existing utilities, either above or below ground, in accordance with the provisions of Section 01510 of these Specifications.

02200.3.10 IRRIGATION DITCHES, PIPES AND STRUCTURES

The CONTRACTOR shall contact the owners of all irrigation facilities to be encountered by the work and make arrangements for construction clearances and/or facility shutdown schedules. All irrigation ditches, dikes, head gates, pipe, valves, culverts, etc., damaged or removed by the CONTRACTOR shall be restored by the CONTRACTOR to their original condition, or better, in accordance with Section 02500 of these Specifications, at no additional cost to the OWNER

02200.3.11 BUILDING FOUNDATIONS AND STRUCTURES

Where trenches are located adjacent to building foundations and structures, the CONTRACTOR shall take all necessary precaution against damage to such facilities. Water settling of backfill material in trenches adjacent to structures will not be permitted unless authorized in writing by the ENGINEER. The CONTRACTOR shall be liable for any damage caused by the construction, and shall restore or replace damaged property in accordance with Section 02500 of these Specifications.

02200.3.11.1 **SIDEWALK, CURB AND GUTTER** - Where sidewalk, curb, and gutter exist, excavation may be made by tunneling provided the following requirements are met. Excavation shall be vertical and as near to the curb or sidewalk as possible. The length of the tunnel shall not exceed the width of the sidewalk, curb and gutter. Where a separate sidewalk and curb exist, an excavation shall be made between the sidewalk and the curb. At least three feet of undisturbed earth shall be left under the sidewalk. Where the excavation does not meet these requirements, a section of sidewalk from joint to joint shall be removed and replaced.

Gas Lines and Water Lines may be jacked, augured or jetted under sidewalk, curb and gutter provided the resulting hole diameter does not exceed one (1) inch plus the outside diameter of the pipe installed.

Backfill of Sidewalk Tunnels. Where the sidewalk has been tunneled, the hole shall be filled from each end with earth compacted with mechanical tampers to 90% of AASHTO T-180, Method C. A 3'-0" section of trench on each side of the tunnel and any space between the sidewalk and curb shall be backfilled with mechanically compacted earth as specified.

02200.3.12 **WATER**

02200.3.12.1 **WATER FLOW** - The CONTRACTOR's operation shall always ensure the free flow of water in gutters, culverts, and natural watercourses. In irrigated land areas, excavated materials shall be piled on the downhill sides of trenches.

02200.3.12.2 **GROUNDWATER** - Unless provided with geotechnical information by the OWNER, the CONTRACTOR shall have the responsibility of determining the presence and location of groundwater at the work site.

02200.3.12.3 **DEWATERING** - Grading and other protective measures shall be performed as necessary to prevent surface or ground water from flowing into trenches or other excavations. Any water accumulated therein during construction, from surface or from underground sources, shall be promptly removed by pumping or by other approved methods at the CONTRACTOR's expense.

Unless given as a separate item in the Bid Schedule, dewatering shall be performed at the expense of the CONTRACTOR. When geotechnical information is given, groundwater must be in excess of ± 2 feet before a change in work will be considered.

02200.3.12.4 **INSTALLATION IN WATER** - No backfill, subgrade materials, concrete or masonry footings, foundations, floors, equipment, or pipe shall be placed or laid in water. Water shall not be allowed to rise over such work for at least 24 hours following the pour or placement of any concrete or mortar used in the work. Water shall not be allowed to rise unequally against structure walls for a period of 14 days following concrete placement or masonry erection.

Groundwater or surface water in piping trenches shall not be allowed to enter and flow through the piping while installation of pipe is in progress.

02200.3.12.5 **DISPOSAL** - The CONTRACTOR shall dispose of all water from the work in a suitable manner without damage to adjacent property

02200.3.13 **BEDDING AND PIPELINES**

02200.3.13.1 **USE OF ON-SITE MATERIALS** - Unless directed otherwise in these Specifications, on-site materials complying with Section 02105 shall be used for bedding. If an act, or failure to act on the part of the CONTRACTOR creates a need to use imported bedding materials, the CONTRACTOR shall bear the cost of all additional excavation, transportation and installation for

new bedding, and for removal and disposal of unacceptable materials, as required to correct that situation.

02200.3.13.2 **INSUFFICIENT ON-SITE MATERIALS** - When sufficient bedding material cannot be developed from on-site materials, and no provision is contained in the Specifications for importing bedding materials, the ENGINEER shall be notified as soon as possible. Alternative measures will be considered and a change can then be negotiated to provide additional materials in accordance with the General Conditions.

02200.3.13.3 **BEDDING INSTALLATION** - Pipe bedding shall be installed according to applicable sections of these Specifications for pipeline construction.

02200.3.14 **BACKFILL**

02200.3.14.1 **BACKFILL MATERIALS AND PLACEMENT** - Backfill shall be accomplished using acceptable materials as described in Section 02105 as follows:

- All backfill materials shall be at $\pm 2\%$ of optimum moisture content when placed in the trench or other excavation.
- Unless provided otherwise on the Drawings, consolidated trench backfill shall be placed in lifts not greater than 8 inches.
- Unsuitable excavated material or material with incorrect moisture content shall be removed and replaced.
- Soft spongy material that causes areas which “pump” when heavy loads pass over them, shall be removed and replaced with suitable material.
- Dry material that will not “ball” shall be removed and replaced.

(The two foregoing conditions shall be considered sufficient evidence, without further testing, that the moisture content is incorrect and shall be grounds for removal and replacement of the material. Such replacement, if required, shall be at the sole expense of the CONTRACTOR.)

- Placement of backfill against cast-in-place concrete structures shall not be started until the concrete has been cured for the time required by the Contract Documents or prescribed by the ENGINEER.

02200.3.14.2 **COMPACTION** – Compaction procedures shall be as follows:

- The CONTRACTOR shall be responsible for obtaining construction water needed for compaction in accordance with Section 02204 of these Specifications.
- Bedding and consolidated backfill material shall be compacted with tamping, vibrating or conventional wheeled compaction equipment. Use care not to damage pipe while compacting bedding materials.
- The use of wheel rolling for compaction shall only be approved for compacting unconsolidated backfill materials.
- For work within state or federal highway rights-of-way, compaction shall meet the requirements of the respective applicable specifications.
- Backfill shall be thoroughly compacted to densities not less than those shown in the following table:

TABLE OF MINIMUM DENSITY REQUIREMENTS
(based on AASHTO-99 and T-91 and on ASTM D-2922 and E-3017)

Location	From Surface to 2-Feet Below Surface	From 2-Feet Below Surface to Top of Bedding	Bedding
Within 6 feet of, and/or under, any existing or proposed structure, pavement, curb, sidewalk, roadway or similar construction included in the Contract:	100% for granular and 95% for non-granular materials	95% for all materials	95% at all locations
Around any structure outside 6 feet:	90% for all materials	90% for all materials	90% at all locations
Cultivated and landscaped areas:	85% for all materials	85% for all materials	85% at all locations
Undeveloped Land:	Unconsolidated – see definition	Unconsolidated - see definition	85% at all locations

02200.3.15 **SETTLING AND SUBSIDENCE**

Dips or uneven surfaces caused by subsidence or post-construction settlement of fill or backfill in any trenches, excavations, fills, or embankments within the work, which become apparent within the warranty period, shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

02200.3.16 **SAMPLING AND TESTING**

02200.3.16.1 **TESTING BY INDEPENDENT LABORATORY** - As directed by the ENGINEER, the CONTRACTOR shall provide for all sampling and testing through a qualified, independent testing laboratory at the CONTRACTOR's own expense.

02200.3.16.2 **SCHEDULE OF SAMPLING AND TESTING** - The following schedule of sampling and testing provides minimum requirements, to assure compliance with all materials and compaction requirements described herein. The number of samples and tests shown shall be considered minimum, and field conditions may necessitate additional sampling and testing to be required by the ENGINEER.

GRADATION DETERMINATION (AASHTO T-27 and T-11)

<u>Trench Location</u>	<u>Testing Required</u>
Materials imported or manufactured at a site determined by this contract	One test per site or source
On-site excavated materials along trenches.	One test per geographical area where material composition and gradation visually appears consistent.

**MOISTURE/DENSITY RELATIONSHIP (Proctor)
(AASHTO T-99 or T-180 Method D)**

<u>Trench Location</u>	<u>Testing Required</u>
Materials imported or manufactured at a site determined by this Contract.	One test per site unless the material visually appears to change.
On-site excavated materials along trenches.	One test per geographical area where material composition visually appears consistent.

**COMPACTION COMPLIANCE TESTING REQUIREMENTS
(AASHTO T-191 or Portable Nuclear Gauges)**

<u>Trench Location</u>	<u>Testing Required</u>
Street crossing with gravel or bituminous surfacing.	One test per lift for each crossing.
Parallel to centerline of bituminous or gravel surfaced streets or roadways.	One test per lift for each 500-feet of trench length.
Along unsurfaced roads or in cultivated or landscaped areas.	One test per lift for each 1,000-feet of trench length with at least one test per area.
Under or adjacent to manholes, wetwells, enclosures, boxes, etc.	None, unless geological conditions are inconsistent and requested by the ENGINEER.

NOTE: The term "test" shall mean a single test with acceptable results, equal to or better than specified minimums. In the event compaction test results fall below the required minimum density; the CONTRACTOR shall re-compact and test the material until a test with acceptable results is obtained. Any test failure shall result in additional tests as required by the ENGINEER, at no cost to the OWNER, to ensure that overall project quality objectives are met.

02200.4 METHOD OF MEASUREMENT

02200.4.1 NO MEASUREMENT

02200.4.1.1 SOLID ROCK EXCAVATION - Unless the Specifications contain provisions for "Solid Rock Excavation", no separate measurement or payment will be made for work requiring rock excavation.

02200.4.1.2 TRENCH EXCAVATION AND BACKFILL - Trench excavation and backfill will be considered incidental to other items shown in the Bid Schedule and separate measurement will not be made unless prescribed otherwise in the Specifications.

02200.4.2 SEPARATE MEASUREMENT

When listed as a separate item in the Bid Schedule, quantities of solid rock excavation shall be determined by the foot/foot unit, using a tape measure or other accurate measuring device to find the length of cut in lineal feet along the plane of cut and the average depth of cut in the rock and multiplying the two numbers together. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching, excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the ENGINEER for payment of completed rock excavation.

02200.5 BASIS OF PAYMENT

Separate payment will not be made for trench excavation unless prescribed otherwise in the Contract Documents.

PAYMENT ITEM	UNIT
Solid Rock Excavation	Foot/Foot

02201.1 DESCRIPTION

This section covers furnishing all equipment, labor, and other facilities to excavate, remove, backfill, compact, grade and shape earth materials required for construction of buildings, bridges, retaining walls, head walls, box culverts and other structures, in accordance with the Contract Documents.

02201.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02500 - Removal and Replacement of Surface Improvements
Section 02900 - Landscaping

02201.1.2 SUBMITTALS

Not used.

02201.1.3 DEFINITIONS

Consolidated Backfill - A condition of backfilling for which a specified compaction density is required. Maximum allowable lifts for consolidated backfill under this Section shall be 8 inches unless otherwise approved by the ENGINEER.

Unconsolidated Backfill - A condition of backfilling for which no compaction density is specified and the required compaction effort is layer placing and then compacting by wheel rolling or use of compacting equipment. Lifts of up to 24 inches are allowed for unconsolidated backfill.

Unclassified Excavation - A determination for excavating whereby no consideration will be given to different kinds of materials that are encountered.

Embankment Fill - The placement and compaction of suitable materials to raise the existing grade to the established elevations, and the placement and compaction of suitable materials within areas where unsuitable materials have been removed. Maximum lift for embankment fill under this Section shall be 6 inches unless otherwise approved by the ENGINEER.

02201.2 MATERIALS

Not used

02201.3 CONSTRUCTION REQUIREMENTS**02201.3.1 PERMITS**

For work within state or federal highway rights-of-way, the CONTRACTOR shall be responsible for obtaining all required encroachment and construction permits prior to beginning any work within the rights-of-way.

02201.3.2 SITE PREPARATION**02201.3.2.1 CLEARING THE SURFACE** - Before proceeding with any ground surface disturbances for work under this Section, the area to be disturbed by excavation, grading or embankments shall be cleared and grubbed in accordance with Section 02015.

- 02201.3.2.2 TOPSOIL - Unless otherwise indicated, the CONTRACTOR will not be required to separate, stockpile and replace topsoil on the Work site. When required in the Contract Documents, topsoil shall be removed and stockpiled for later distribution in accordance with Section 02015.
- 02201.3.2.3 REMOVAL OF SUBSURFACE MATERIALS - Following completion of clearing and grubbing, the CONTRACTOR shall locate and remove existing underground debris, posts, piping, cables and other underground obstructions. Unless indicated otherwise in the Contract Documents, no separate allowance for costs associated with removal of these materials will be allowed to the CONTRACTOR.
- 02201.3.2.4 RELOCATION OF UNDERGROUND UTILITIES - When required by the Contract Documents or determined necessary by the ENGINEER, existing underground utilities or other objects shall be relocated to provide clearance for required structural components prior to starting any structural excavation.
- 02201.3.3 EXCAVATION
- 02201.3.3.1 UNCLASSIFIED EXCAVATION - All excavation shall be unclassified, unless otherwise indicated in the Contract Documents. The CONTRACTOR shall perform all excavation to the elevations and dimensions shown on the Drawings and/or as required to accomplish the Work.
- 02201.3.3.2 CUT SLOPES - Unless otherwise shown on the Drawings, or directed by the ENGINEER, cut and fill slopes, or cut slopes in soil, shall be no steeper than two horizontal to one vertical. Cut slopes in rock shall be no steeper than 1.5 horizontal to one vertical.
- 02201.3.3.3 STOCKPILING AND DISPOSAL OF EXCAVATED MATERIALS - During the excavation operations, excavated materials which are suitable for use as backfill or embankments around structures, shall be piled separately at sufficient distance from the opening to be out of the way of equipment and to prevent slides or cave-ins.
- All excavated materials not suitable, or not required, for fill or backfill shall be removed promptly from the site of the Work and disposed of in accordance with Section 01520.
- Excavated materials, regardless of their disposition, shall be piled in such manner that will cause the minimum of inconvenience to public travel, and provisions shall be made for emergency travel as necessary.
- 02201.3.3.4 SHORING AND BRACING - Shoring or bracing shall be provided in accordance with OSHA safety requirements on all excavations, to protect workmen and the progression of the Work. In addition, excavation walls shall be braced and supported as required to prevent ground collapse or movement of ground surfaces and structures adjacent to the excavation. Slides or settlements, which occur in the excavation, shall be promptly removed and corrected by the CONTRACTOR. The arrangement of shoring and bracing components shall be made so as not to place any stress on portions of completed work.
- 02201.3.4 EXCAVATION IN ROCK
- 02201.3.4.1 SOLID ROCK EXCAVATION - Demonstration of the presence of "solid rock excavation" may constitute a changed condition, and the CONTRACTOR will be compensated for removal of such material in accordance with the General Conditions. Before excavation will be considered as "solid rock excavation", the CONTRACTOR shall demonstrate an inability to remove rock by making three attempts to rip the rock using equipment having not less than 235 fly wheel horsepower with a "Kelly" or similar type ripper. After such demonstration has indicated the presence of solid rock, and the ENGINEER determines its removal is necessary, authorization for removal of the solid rock may be granted in accordance with Section 00700.13 of the General Conditions.

02201.3.4.2 **BLASTING** - When blasting is deemed necessary for rock removal, the CONTRACTOR shall comply with all applicable State and Local laws, ordinances, and provisions for blasting safety and obtain written approval from the ENGINEER prior to starting of drilling and/or blasting operations.

In all cases, blasting shall be performed by experienced, qualified blasters. The CONTRACTOR is responsible for any and all damage caused by blasting, and blasting will not be allowed within 15 feet of any existing structures.

02201.3.5 **OVER-EXCAVATION**

02201.3.5.1 **UNAUTHORIZED OVER-EXCAVATION** - Care shall be taken not to excavate below the depth required by the Drawings. Any unauthorized over-excavation shall be refilled and compacted with material meeting the requirements of Section 02105 and approved for use by the ENGINEER at the expense of CONTRACTOR.

02201.3.5.2 **UNSTABLE NATIVE FORMATIONS** - The CONTRACTOR shall notify the ENGINEER if soft, spongy, or otherwise unstable native formations, unsuitable for structure foundations, are encountered during excavation. In the event the ENGINEER determines that such formations are inadequate, the CONTRACTOR will be directed to over-excavate and remove the unsuitable materials. The over-excavation shall be backfilled with approved select materials and compacted in accordance with the requirements described herein. Such situation will be considered as a changed condition and the CONTRACTOR will be compensated in accordance with the General Conditions.

02201.3.6 **WATER**

02201.3.6.1 **DEWATERING** - The CONTRACTOR shall control all ground or surface water during excavation, grading and subsequent construction activities. Dewatering systems shall be provided and operated by the CONTRACTOR so as to prevent the removal of the natural soils. Grading shall be performed as necessary to prevent surface water from flowing into excavations. Any water accumulated, therein during construction, shall be promptly removed by pumping or by other approved methods at the CONTRACTOR's expense.

Dewatering efforts shall be sufficient to ensure that softening of the bottom of excavations or formation of "quick" conditions or "boils" shall be prevented. Natural or compacted materials within the excavated areas, softened by saturation with ground water or standing surface water, shall be removed and replaced as instructed by the ENGINEER, at no additional cost to the OWNER.

02201.3.6.2 **INSTALLATION IN WATER** - No backfill, subgrade materials, concrete or masonry footings, foundations, floors, equipment, or pipe shall be placed or laid in water. Water shall not be allowed to rise over such work for at least 24 hours following the pour or placement of any concrete or mortar used in the Work. Water shall not be allowed to rise unequally against structure walls for a period of 14 days following concrete placement or masonry erection.

02201.3.6.3 **DISPOSAL** - Any water to be removed from the Work site shall be disposed of by the CONTRACTOR in a suitable manner without damage to adjacent property.

02201.3.6.4 **REFERENCE** - See also Section 02200.3.12.

02201.3.7 **SCARIFICATION**

After excavating to the lowest subgrade elevation shown on the Drawings, and prior to placement of the structure footings or foundation components, unless otherwise directed by the ENGINEER, the top 6 inches of the subgrade shall be scarified, brought to the proper moisture content, and compacted in accordance with the Table of Minimum Density Requirements below.

02201.3.8 **EMBANKMENT FILL AND BACKFILL**

02201.3.8.1 **ON-SITE BACKFILL MATERIALS** - Unless directed otherwise by the ENGINEER or the Contract Documents, on-site materials complying with Section 02105 shall be used for all embankment, fill and backfill materials. Before on-site material becomes unavailable, and when provisions are not included in the Contract Documents for importing suitable materials, the CONTRACTOR shall notify the ENGINEER so that a change can be negotiated in accordance with the General Conditions.

02201.3.8.2 **PLACEMENT IN LIFTS** - Unless provided otherwise on the Drawings, suitable embankment fill, backfill, and bedding materials shall be placed in lifts which will be not greater than 6 inches thick after compaction. Bedding materials shall be moisture conditioned (by wetting or drying), before being placed in layers for compaction in accordance with the requirements of the Table of Minimum Density Requirements below.

02201.3.8.3 **UNSUITABLE FILL AND BACKFILL MATERIALS** - Any unsuitable fill and/or backfill material found within excavated materials, or material with incorrect moisture content shall be removed and replaced. Soft spongy material, causing areas that "pump" when heavy loads are passed over them, shall be removed and replaced with suitable material. Dry material that will not "ball" shall be removed and replaced. The two foregoing conditions shall be considered sufficient evidence, without further testing, that the moisture content is incorrect and shall be grounds for removal and replacement of the material. Such replacement if required shall be at the sole expense of the CONTRACTOR, and shall be accomplished prior to placement of any further material.

02201.3.9 **COMPACTION**

02201.3.9.1 **MINIMUM DENSITY REQUIREMENTS** - After placement, all materials shall be thoroughly compacted to not less than the densities indicated in the table below. Compaction shall be achieved and verified in accordance with AASHTO T-99, ASTM D-1556, ASTM D-1557, ASTM D-2922 and/or ASTM D-3017 as applicable.

**TABLE OF MINIMUM DENSITY REQUIREMENTS
(Based on AASHTO-99 and T-91 and on ASTM D-2922 and E-3017)**

Location	From Surface to 2-Feet Below Surface	From 2-Feet Below Surface to Top of Bedding	Bedding
Within 6 feet of, and/or under, any existing or proposed structure, pavement, curb, sidewalk or similar construction included in the Contract:	100% for granular and 95% for non-granular materials	95% for all materials	95% at all locations
Around any structure outside 6 feet:	90% for all materials	90% for all materials	90% at all locations
Cultivated and landscaped areas:	85% for all materials	85% for all materials	85% at all locations
Undeveloped land:	Unconsolidated - see 02201.1.3	Unconsolidated - see 02201.1.3	85% at all locations

02201.3.9.2 **OTHER SPECIFICATIONS** - For work within state or federal highway rights-of-way, compaction shall meet the requirements of the respective applicable specifications.

- 02201.3.9.3 **COMPACTION EQUIPMENT** - Embankment fill and consolidated backfill material shall be compacted with conventional tamping or vibrating compaction equipment of such capacity and weight to achieve the required compaction density. The use of wheel rolling for compaction shall only be approved for compacting unconsolidated backfill materials.
- 02201.3.9.4 **PLACEMENT AGAINST STRUCTURES** - Embankment fill or backfilling against cast-in-place concrete structures shall not be started until the concrete has been cured for the time required by these Specifications or prescribed by the ENGINEER. Compaction within 3 feet of any new or existing structure shall be by hand operated vibratory or tamping equipment.
- 02201.3.9.5 **CONSTRUCTION WATER** - The CONTRACTOR shall be responsible for obtaining construction water needed for compaction in accordance with Section 02204.
- 02201.3.10 **SETTLING AND SUBSIDENCE**
- Dips or settlement of fill or backfill in any excavation or embankment within the Work, which occur within the warranty period, shall be repaired by the CONTRACTOR at no additional cost to the OWNER.
- 02201.3.11 **SAMPLING AND TESTING**
- 02201.3.11.1 **INDEPENDENT LABORATORY** - The CONTRACTOR shall provide all required sampling and testing by an independent qualified testing laboratory as directed by the ENGINEER.
- 02201.3.11.2 **SCHEDULE OF SAMPLING AND TESTING** - The following schedule of sampling and testing provides minimum requirements, to assure compliance with all materials and compaction requirements described herein. The number of samples and tests shown shall be considered minimum, and field conditions may necessitate additional sampling and testing to be required by the ENGINEER.

GRADATION DETERMINATION (AASHTO T-27 and T-11)

Location	Testing Required
Materials imported or manufactured at a site determined by this contract	One test per site or source
On-site excavated materials along trenches	One test per geographical area where material composition and gradation visually appears consistent.

**MOISTURE/DENSITY RELATIONSHIP (Proctor)
(AASHTO T-99 or T-180 Method D)**

Location	Testing Required
Materials imported or manufactured at a site determined by this Contract.	One test per site unless the material visually appears to change.
On-site excavated materials along trenches.	One test per geographical area where material composition visually appears consistent.

**COMPACTION COMPLIANCE TESTING REQUIREMENTS
(AASHTO T-191 or Portable Nuclear Gauges)**

Location	Testing Required
Under Structure footing or foundation	One test per lift for each 100 linear feet.
Within an embankment erected to support a structure under structure floor slabs	One test per lift for each 1,000 square feet.
Within embankments for cultivated or landscaped areas.	One test per lift for each 5,000 square feet.

NOTE: The term "test" shall mean a single test with acceptable results, equal to or better than specified minimums. In the event compaction test results fall below the required minimum density; the CONTRACTOR shall re-compact and test the material until a test with acceptable results is obtained.

02201.3.12 **GRADING**

Upon completion of excavation, the site shall be accurately graded to the spot elevations and slopes shown on the Drawings, to allow proper installation of the structure in accordance with applicable Sections of these Specifications.

02201.4 METHOD OF MEASUREMENT

02201.4.1 **NO MEASUREMENT**

Separate measurement will not be made for earthwork for structures. Unless the Contract Documents contain provisions for "Solid Rock Excavation", no separate measurement or payment will be made for work requiring rock excavation.

02201.4.2 **SEPARATE MEASUREMENT**

When listed as a separate item in the Bid Schedule, quantities of solid rock excavation shall be determined by the foot/foot unit, using a tape measure or other accurate measuring device to find the length of cut in lineal feet along the plane of cut and the average depth of cut in the rock and multiplying the two numbers together. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching, excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the ENGINEER for payment of completed rock excavation.

02201.5 BASIS OF PAYMENT

Payment for earthwork for structures shall be included in the unit prices provided for the respective structure elements listed in the Bid Schedule. When listed as a separate item on the Bid Schedule, payment for "Solid Rock Excavation" will be made as follows:

PAYMENT ITEM	UNIT
Solid Rock Excavation	Foot/Foot

02203.1 DESCRIPTION

Work under this section shall include complete construction of a pond, dike, or system of ponds for containment of water as specified herein. The work of this section shall include excavation and grading, embankment placement, trenching and backfilling, roadway construction and subsidiary work, and disposal of excess excavated material as required to complete construction of the ponds.

To aid in the design of ponds, a geotechnical engineering consultant may be employed by the OWNER or the ENGINEER to investigate the soils on the site for the purpose of evaluating subsurface conditions and for making recommendations for their utilization in construction. If this work has been done, a copy of the geotechnical report is included as an exhibit to the Contract.

02203.1.1 RELATED WORK

Section 01510 - Protection of Existing Properties
Section 01520 - Environmental Controls
Section 01560 - Construction Staking
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 02204 - Water for Construction

02203.1.2 SUBMITTALS

Not used.

02203.1.3 DEFINITIONS

Ponds - Include reservoirs, lagoons, dikes, or any earth structures constructed for holding water or wastewater.

Excavation - Earth materials removed from their original position to form the configuration of pond components and subsidiary earth structures shown on the Drawings.

Embankment - Excavated materials obtained on the Work site and placed in configurations shown on the Drawings to form pond components and subsidiary earth structures.

Subgrade - The surface of embankment or excavated areas graded according to the details shown on the Drawings and prepared to receive a liner or other covering layer.

Unsuitable Material - Excavated materials determined by the ENGINEER to be unsuitable for placement in embankments. Such materials may include rock too large for placement in embankment, soil containing excessive vegetative debris, soils with excessive permeability, unstable earth materials, etc.

Borrow - Earth materials imported to the site of the pond construction from sources outside the Work site.

Unclassified Material - Excavated materials for which no classification has been made to establish different, or separate, prices for their excavation or placement in the Work.

Clay Liner - Earth or other materials installed in the pond to form a surface which restricts or prevents water seepage from the pond bottom and banks.

Cushion - Earth material installed as a protective layer between defined earth or structural components.

02203.2 MATERIALS

02203.2.1 EARTH MATERIAL

Shall meet the requirements provided herein and prescribed in other referenced sections of these Specifications.

02203.2.2 CLAY LINERS

Clay material obtained on site, or from off-site sources approved by the ENGINEER, having a permeability of less than 1.0×10^{-6} cm/sec. Clay material shall be moisture conditioned to optimum conditions for placement and shall not contain particles greater than 1/2-inch diameter. Minimum liquid limit shall be 30.

02203.2.3 NON-CLAY LINERS

Non-clay liners shall be materials meeting the requirements provided in the Contract Documents and shown on the Drawings.

02203.2.4 PIPING AND OTHER STRUCTURAL MATERIALS

Shall meet the configuration and requirements shown on the Drawings, other referenced sections of these Specifications, and the Contract Documents.

02203.2.5 ON-SITE MATERIALS

Materials encountered during excavation and determined by the ENGINEER to be suitable for use in the Work; they should be conserved and utilized in lieu of materials from off-site sources.

02203.2.6 WATER

Water used for construction shall be developed, hauled and applied in accordance with Section 02204.

02203.3 CONSTRUCTION REQUIREMENTS

02203.3.1 REGULATORY REQUIREMENTS OF WASTEWATER LAGOON CONSTRUCTION

The construction of wastewater lagoon systems shall meet or exceed all applicable requirements for wastewater facility construction of the state in which the system is being constructed.

02203.3.2 CONSTRUCTION STAKING

Staking for locating and for initiating construction of ponds and their subsidiary components shall be provided in accordance with Section 01560. Additional staking determined necessary by the CONTRACTOR shall be provided by the CONTRACTOR.

02203.3.3 DEWATERING

Where the ground water is higher than 2 feet below the finished pond bottom grade, the first construction operation at the lagoon site shall be to install the drain system. The drain system shall include all drain trenches, drain gravel, perforated pipe, manholes, drain waste pipe, and drain

discharge end sections, as shown on the Drawings. When required by local regulations, piezometers will be installed by the ENGINEER at random locations throughout the site. No other construction, with the exception of clearing and grubbing, may take place until the site has been sufficiently de-watered. When ground water has subsided to 2-feet below the finished pond bottom grade, the CONTRACTOR may proceed with earthwork operations.

02203.3.4 CLEARING AND GRUBBING

The CONTRACTOR shall completely clear and grub the entire site within the boundary of the pond or lagoon dikes in accordance with Section 02015 before any excavation or embankment begins. This operation shall include removal of the first 6 inches of organic laden top soil, which shall be stockpiled for later use as a protective layer over the clay liner of each pond or lagoon bottom.

02203.3.5 EXCAVATION

The CONTRACTOR shall provide all necessary equipment, materials and labor required to construct ponds to the neat lines and finished grades shown on the Drawings.

02203.3.5.1 SEGREGATION AND STOCKPILING - As part of the excavation operation, the CONTRACTOR shall stockpile excavated materials into select categories as required herein. Excavated silt/clay material shall be separated from the sands and gravels and placed in individual stockpiles to be used later for embankment and liner construction. Soils with the highest clay content (CL and CL - ML soil types) shall be further separated from the remaining sandy silt soils (ML soils) for reuse specifically as liner material when a clay liner is required by the Contract Documents.

02203.3.5.2 TESTING FOR SOIL CHARACTERISTICS - Due to the inherent variability in the occurrence of soil types, it is required that frequent inspection, sampling and testing be performed during construction. This is necessary to verify that actual material properties (primarily permeability and compaction) are consistent with those projected from preliminary investigation and recommendations in the geotechnical report.

02203.3.5.3 SITE INVESTIGATION FOR CLAY LINER MATERIAL - When a clay liner is required, the CONTRACTOR shall investigate the extent of occurrence of granular soils across the entire wastewater lagoon bottom area. This shall be accomplished by excavating shallow test pits to a depth of 18-inches below the level of the bottom of the liner in a 50-foot (minimum) grid pattern. Wherever granular soils are encountered at a depth of less than one foot below the bottom of the planned liner, the soils shall be excavated and replaced to ensure a minimum one-foot thick blanket of fine-grained soil beneath the clay liner. The granular soils removed shall then be replaced to the level of the bottom of the liner with fine-grained silt or clay soils; moisture conditioned and compacted as required in this Section.

02203.3.5.4 CONDITIONING OF SOILS - Exposed soils inside the pond area shall not be allowed to dry out and crack. If drying and cracking of those soils occurs, the material shall be re-scarified, moisture conditioned to the recommended value and recompacted. As an alternative, any dried or cracked soils may be removed and replaced with properly conditioned, approved materials with an acceptable moisture content.

02203.3.5.5 UNAUTHORIZED OVER-EXCAVATION - Care shall be taken to avoid excavation beyond Drawing requirements. Any unauthorized over-excavation shall be repaired at the expense of CONTRACTOR, and as directed by the ENGINEER, using materials meeting requirements of Section 02105.

02203.3.5.6 WASTING OF EXCESS MATERIALS - Excess excavated materials may be wasted on the exterior of pond dikes, when approved by the ENGINEER; however, such waste area shall be finished similarly to the dike slope.

02203.3.5.7 **REMOVAL AND DISPOSAL OF EXCESS AND UNSUITABLE MATERIALS** - Other methods of excess material disposal shall be as directed by the ENGINEER. Unsuitable material shall be removed and disposed of in accordance with the Contract Documents or as directed by the ENGINEER. Areas from which unsuitable materials have been removed, shall be backfilled and compacted with suitable material as necessary to complete the Work and as directed by the ENGINEER.

02203.3.5.8 **FROZEN MATERIALS** - Snow, ice, or other frozen material shall not be placed in the Work. If a snow event should occur during construction of the pond or lagoon, the snow shall be removed and deposited outside the pond area prior to resuming construction.

02203.3.6 **ROCK EXCAVATION**

02203.3.6.1 **CHANGE IN THE WORK** - Unless shown otherwise in the Contract Documents, all excavation shall be considered unclassified and no separate measurement or payment will be authorized for work requiring rock excavation unless a changed condition is determined by the OWNER and ENGINEER.

02203.3.6.2 **SOLID ROCK EXCAVATION** - If the OWNER and ENGINEER determine a changed condition for rock excavation is necessary; the CONTRACTOR shall be compensated for removal of such material in accordance with the provisions of the General Conditions. A changed condition may be determined if significant unforeseen solid rock is encountered and the CONTRACTOR demonstrates an inability to remove rock after making three attempts to rip the rock using equipment having not less than 235 fly wheel horsepower and equipped with a "Kelly" or similar type ripper. If it is determined a changed condition, excavation of such material will be considered as "Solid Rock Excavation" and such demonstration shall constitute a changed condition.

02203.3.6.3 **BLASTING** - When blasting is deemed necessary for rock excavation, the CONTRACTOR shall comply with all applicable State and Local laws, ordinances, and provisions for blasting safety and obtain written approval from the ENGINEER prior to starting of drilling and/or blasting operations.

In all cases, blasting shall be performed by experienced, qualified blasters. The CONTRACTOR is responsible for any and all damage resulting from blasting. Blasting will not be approved within 15 feet of any existing structure.

02203.3.7 **COMPACTION**

02203.3.7.1 **ROLLER REQUIREMENTS** - Compaction equipment shall be any one of the types listed below, with the minimum characteristics shown for each type:

- Sheepfoot, tamping or grid rollers, capable of exerting a force of 250 pounds per inch of width of roller drum.
- Steel-wheel rollers, capable of exerting a force of not less than 250 pounds per inch of width of the roller drum.
- Vibratory steel-wheel rollers, with a minimum weight of 6 tons. Such compactors shall be equipped with amplitude and frequency controls.
- Pneumatic-tire rollers, with smooth tread tires of equal size that will provide a uniform compacting pressure for the full width of the roller and capable of exerting a ground pressure of at least 80 psi.

- 02203.3.7.2 **OPERATION** - Compaction equipment shall be operated over the full width of each layer until visible deformation of the layer ceases or, in the case of the sheepsfoot roller; the roller "walks out" of the layer. A minimum of three passes shall be made over the entire area of compaction regardless of the type of compaction equipment used.
- 02203.3.8 **POND EMBANKMENTS**
- 02203.3.8.1 **PLACEMENT** - Pond or lagoon dike embankments shall be layer placed in loose horizontal lifts not exceeding 8 inches thick prior to compaction. Embankments and the top 12-inches of excavation sections shall be brought to slightly above optimum moisture content and compacted to a minimum of 90 percent of the maximum dry density as determined by the AASHTO T-180.
- 02203.3.8.2 **UTILIZATION OF FINE GRAINED MATERIALS** - Fine-grained soils are intended to be utilized on the inside surfaces of the pond bottoms and dike surfaces. Where sufficient fine-grained materials are not available on site for utilization throughout embankments, granular soils may be used to complete the outward one third of the dike embankments. No separate measurement and payment for such utilization will be allowed unless provided otherwise in the Contract Documents.
- 02203.3.9 **FINISHING EARTHWORK SURFACES**
- Excavated and embankment surfaces shall be uniformly graded and finished in conformance to the lines and grades shown on the Drawings. When completed, the average plane of the slopes shall conform to the construction tolerances provided in this Specification. The tops of excavation slopes and the ends of excavations shall be trimmed to remove any overhang or rounded when shown on the Drawings.
- 02203.3.10 **PREPARATION FOR CLAY LINER**
- 02203.3.10.1 **SUBGRADE PREPARATION** - When excavation of the pond bottom is achieved to subgrade, the CONTRACTOR shall scarify and loosen the top 6 inches of the subgrade surface through the use of conventional disking, forking or other means. The subgrade surface shall then be evenly graded with rough and fine grading and leveled to the lines, grades, and elevations shown on the Drawings. Subgrade shall then be compacted to 90 percent of the maximum density as determined by AASHTO Method T-180.
- 02203.3.10.2 **ENGINEER APPROVAL** - Before the CONTRACTOR proceeds with installation of the clay liner, the subgrade surface shall be examined and approved by the ENGINEER.
- 02203.3.11 **CLAY LINER CONSTRUCTION**
- 02203.3.11.1 **MATERIALS** - Only clay materials having a permeability of less than 1.0×10^{-6} cm/sec from the lagoon excavation shall be used for clay linings. Remove rocks, debris, vegetation and other detrimental material from the clay material as directed by the ENGINEER during construction.
- 02203.3.11.2 **MIXING** - Clay liner material shall be thoroughly mixed, scarified, blended, processed, disked, or rotomixed to provide a uniform content and gradation throughout the placement operations.
- 02203.3.11.3 **MOISTURE CONTENT** - During mixing, clay liner material shall be moisture conditioned. It shall be brought to within 2 percent (+ or -) of the optimum moisture content before spreading and compaction is started. Any dried clay soils containing particles (clods) larger than 1/2-inch shall be reprocessed and moisture conditioned to eliminate particles of greater sizes prior to placement. If the moisture content in the stockpiled material is higher than permissible limits, disk the soil and allow to air dry before placing.

If drying and cracking occur in the liner before the ENGINEER has issued final acceptance of the Work, the material shall be scarified, moisture conditioned to the recommended value, and re-compacted. As an alternative to re-scarification and re-compaction, any dried or cracked liner material may be removed and replaced with new liner materials.

02203.3.11.4 **PLACEMENT** - Placement of the clay liner shall be made in at least two separate lifts, 6" maximum compacted thickness. The first lift shall be completely installed, compacted and verified before the second lift is started.

Each lift shall be uniform using scrapers, dozers, motor graders, or similar and manipulated until the desired thickness is achieved and significant humps, swales, windrows, and ridges are removed.

02203.3.11.5 **CLAY LINER COMPACTION**

- **Compaction Equipment.** The compactor shall be a static smooth drum roller either self-propelled or towed. Use hand-held mechanical compactors or tampers on difficult areas, which are inaccessible or impractical for large compacting equipment.
- **Compaction Process.** Liner material shall be compacted to a minimum of 90 percent of the maximum dry density as determined by the AASHTO T-180. If there is a break in the compaction operation of more than 24 hours, scarification of at least 2 inches in depth is required.

02203.3.12 **CONSTRUCTION TOLERANCES**

Unless provided otherwise in the Drawings or Contract Documents, the tolerance for allowable deviation from construction staking requirements shall be as shown in the table below:

CONSTRUCTION TOLERANCES

Measurement	Tolerance
Bank Top Width (feet)	Not less than dimensions shown on the Drawings and not more than one (1) foot.
Subgrade Elevation, Line and Grade (feet)	+0.2
Clay Liner Elevation, Line and Grade (feet)	+0.2
Clay Liner Thickness (feet)	+0.2 - 0.0
Deviation of Slope Plane Surfaces	Not more than 6-inches measured perpendicular to the slope surface

02203.3.13 **TESTING AND QUALITY CONTROL**

02203.3.13.1 **TESTING SERVICE** - The CONTRACTOR shall be responsible for soils and compaction testing during construction. The CONTRACTOR shall obtain the ENGINEER's approval of the selected testing service provider at least ten (10) days before pond excavation and/or embankment placement is started. Approval of the CONTRACTOR's testing service provider shall be based on a statement of qualifications, which shall be submitted to the ENGINEER.

02203.3.13.2 **PERMEABILITY TESTING** - Permeability testing shall be done by single ring infiltrometer (SRI) tests performed in-situ. SRI's shall be performed on each lift of liner materials at random locations selected by the ENGINEER. Two SRI tests shall be performed for each lift in treatment lagoon cells, and three SRI tests shall be performed for each lift in storage lagoon cells. Sufficient time shall be allowed to be sure that each lift of the clay liner passes the required tests before construction of subsequent lifts begins. If a test fails, immediate retests shall be conducted, at which time the ENGINEER shall direct the CONTRACTOR on further proceedings.

02203.3.13.3 **COMPACTION TESTING** - Compaction testing shall conform to ASTM D-1557. A new test shall be prepared for every change in soil type. Compaction shall be tested at the rate of one test for every 21,000 square feet of compacted material surface area, or as directed by the ENGINEER. The locations of compaction tests shall be selected at random by the ENGINEER. Each liner or embankment lift shall be tested to assure proper compaction prior to placement of any subsequent lift.

02203.3.13.4 **FAILURE TO MEET TESTING REQUIREMENTS** - Areas of embankments, subgrades or liner, which fail to meet compaction testing requirements, shall be scarified, brought to the proper moisture content and recompacted until tests results show compliance. Reworked areas shall be retested until they meet project requirements. Rework and retesting required as a result of any failed test shall be performed at the sole expense of the CONTRACTOR.

Areas of clay liner that fail to meet permeability requirements shall be removed and replaced with suitable clay liner materials. Additional tests shall be performed at the direction of the ENGINEER and at the expense of the CONTRACTOR, to ensure that permeability requirements are met for the liner. Reworked areas shall be retested until they meet project requirements.

02203.4 METHOD OF MEASUREMENT

02203.4.1 LUMP SUM

Measurement for pond, dike, or lagoon construction shall be by the lump sum. Measurement shall include all excavation, segregation, spreading, fill, dike or embankment construction, and all other work necessary to complete the pond or lagoon to the lines, grades, elevations and dimensions shown on the Drawings.

Notwithstanding the foregoing, the ENGINEER shall calculate the total cubic yards of compacted embankment in place to the neat lines shown on the plans. A construction note on the plans shall indicate this yardage along with the shrink factor used to balance the excavation (cut) with the embankment (fill) and, if applicable, the yardage of import or export. This information is provided to assist the CONTRACTOR in understanding the scope of work; however, the CONTRACTOR shall ascertain for itself the work required to complete the Project and shall base its bid correspondingly.

02203.4.2 NO MEASUREMENT

Unless identified in the Bid Schedule, inlet structures, outlet structures, transfer structures and level indicators shall be included in pond or lagoon construction, and no separate measurement shall be made for these items. When identified in the Bid Schedule, measurement for inlet structures, outlet structures, transfer structures and level indicators shall be by the units identified in the Bid-Schedule.

02203.4.3 SEPARATE MEASUREMENT

02203.4.3.1 **RIPRAP** - Quantity of riprap shall be determined in the field using a tape measure or other accurate measuring device to find the length and width of liner in place and accepted. The length shall be multiplied by the width and by the minimum depth shown on the Plans to determine the volume to be converted to cubic yards.

02203.4.3.2 **CLAY LINER** - Quantity of clay liner shall be determined in the field using a tape measure or other accurate measuring device to find the length and width of liner in place and accepted. The length shall be multiplied by the width and by the minimum depth shown on the Plans to determine the volume to be converted to cubic yards.

02203.4.3.3 **SOLID ROCK EXCAVATION** - When listed as a separate item in the Bid Schedule, quantities of solid rock excavation shall be determined by the foot/foot unit, using a tape measure or other accurate measuring device to find the length of cut in lineal feet along the plane of cut and the average depth

of cut in the rock and multiplying the two numbers together. This measurement shall include all labor, equipment, materials, and related work, including, but not limited to, ripping, sawing, boring, hammering, blasting, rock trenching, excavating, removing, hauling, and disposal, if required, of the existing bedrock deemed qualified by the ENGINEER for payment of completed rock excavation.

02203.5 BASIS OF PAYMENT

When identified in the Bid-Schedule, accepted quantity(s) will be paid for at the contract unit rate for:

PAY ITEM	UNIT
Pond or Lagoon Construction	Lump Sum
Inlet Structure	Each
Outlet Structure	Each
Transfer Structure	Each
Level Indicator	Each
Rip Rap	Cubic Yard
Clay Liner	Cubic Yard
Solid Rock Excavation	Cubic Yard

02204.1 DESCRIPTION

Furnish and apply water for: dust control, pre-wetting, mixing or compacting earth materials for road, site, and/or trench construction, and for other needs associated with the Work.

02204.1.1 RELATED WORK

Not used.

02204.1.2 SUBMITTALS

Not used.

02204.1.3 DEFINITIONS

Not used.

02204.2 MATERIALS

Water shall be free of dirt and silt or any substances injurious to plant life. A separate supply of potable water shall be provided for drinking when it becomes necessary to provide water for workers.

02204.3 CONSTRUCTION REQUIREMENTS

Water provided for construction shall be obtained from a source approved by the Engineer and sufficient to provide for the anticipated needs of the contract.

Water hauling equipment shall have watertight tanks of known capacity and shall be equipped with a pressure pump and spray system with the capability of applying the whole load uniformly. The spray system shall have a positive shut-off control. The water tank shall have a minimum capacity of 1,000 U.S. Gallons, and the capacity shall be clearly marked on the tank. The CONTRACTOR may be required to verify the tank capacity.

A water meter may be used for water dispensing, providing its measurement can be verified.

02204.4 METHOD OF MEASUREMENT

Unless indicated otherwise in the Bid Schedule, no separate measurement will be made for water used for pre-wetting, mixing, or compaction of earth materials or for dust control.

When shown in the Bid Schedule, water shall be measured to the nearest 1/10th of 1000 gallons in calibrated tanks or tanks with approved metering devices that indicate volume in 100-gallon quantities.

02204.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Water	M Gallons (1,000 US Gallons)

02206.1 DESCRIPTION

This section covers activities associated with two types of temporary road use. These are construction and use of access roads and use of existing roads which are part of the construction zone.

02206.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 01300 - Submittals
Section 02005 - Traffic Control
Section 02015 - Clearing and Grubbing
Section 02105 - Earthwork Materials
Section 02202 - Roadway Excavation and Embankment

02206.1.2 SUBMITTALS

When gravel surfacing is required, the CONTRACTOR shall submit samples and/or test data for those materials in accordance with Sections 02105 and 01300.

02206.1.3 DEFINITIONS

Access Roads – A project site access road built specifically for temporary use by project related vehicles during the construction phase of the Work. The road may be on or partially on the construction zone or only end at it.

Temporary Use of Roads – Use of an existing paved or unpaved roadway during the construction phase of a project involving degradation of the surface and/or the use of the road by the public. Temporary road use may constitute use of the roadway as all or part of the construction zone or as an immediate approach to the construction zone.

02206.2 MATERIALS**02206.2.1 ACCESS ROADS**

When shown on the Drawings, surfacing material for access roads shall be Untreated Base Course (UBC) gravel which meets the requirements of Section 02105.

02206.2.2 TEMPORARY USE OF ROADS

Materials requirements for restoring and resurfacing existing roads that have been damaged or disturbed during construction will be as shown on the Plans and described elsewhere within these Specifications.

02206.3 CONSTRUCTION REQUIREMENTS**02206.3.1 ACCESS ROADS**

Consists of excavating, filling, installing gravel surfacing, and other work necessary to construct minor access roads for which cut and fill quantities will not be determined.

02206.3.1.1 CLEARING - The area to be disturbed by the road construction operation shall be cleared of all trees, brush, rubbish and other objectionable matter in accordance with Section 02015 prior to beginning the trenching operation. Trees, brush, rubbish and other materials resulting from the clearing operation shall be removed and disposed of at a land fill approved by the local public

authority or designated by the ENGINEER. Removal of these materials shall be considered as part of the Work for access road construction and no separate measurement and payment will be made for their removal.

02206.3.1.2 UNSUITABLE MATERIAL - Material shall be considered unsuitable for fill, sub-grade, shoulders and other uses if it contains organic matter, soft spongy earth or other matter of such nature that compaction to the specified density is unobtainable.

Material that is unsuitable for the intended use shall be excavated and removed from the site to an approved disposal site or otherwise disposed of as directed by the ENGINEER.

02206.3.1.3 SLOPES – Slopes shall be as follows:

- Excavation slopes shall be finished in conformance with the lines and grades shown on the Drawings. Debris and loose material shall be removed.
- Tops of slopes shall be rounded as shown on the Drawings. Excavation and embankment lines shall conform to those shown on the Drawings. When completed, the road grade shall be uniform and shall provide a smooth driving surface for vehicles.

02206.3.1.4 MATERIAL AVAILABILITY - The CONTRACTOR shall utilize all suitable excavated material within the roadway. When it is determined that sufficient excavated material is not available to construct required embankment, the ENGINEER may designate borrow sites and, if deemed to be changed conditions, appropriate changes will be negotiated in accordance with the General Conditions.

02206.3.1.5 COMPACTION - Materials in embankments shall be placed in layers not more than 12-inches in thickness and then wheel rolled with the equipment used for placement.

Placement of surfacing shall be made in accordance with the details shown on the Drawings and then compacted by wheel rolling with equipment used for placement.

02206.3.1.6 TRAFFIC CONTROL - At all points where access roads come into contact with public thoroughfares, the CONTRACTOR shall establish and maintain adequate traffic control as described in Section 02005 and as required by the specifications of the state or local highway or road department having authority at the site.

02206.3.1.7 ENVIRONMENTAL CONTROL – During construction and use of access roads, the CONTRACTOR shall observe the requirements of Section 01520 with particular regard to dust abatement.

02206.3.2 TEMPORARY USE OF ROADS

02206.3.2.1 TRAFFIC CONTROL - At all times when the CONTRACTOR is making temporary use of public thoroughfares, the CONTRACTOR shall establish and maintain adequate traffic control as described in Section 02005 and as required by the specifications of the state or local highway or road department having authority at the site.

02206.3.2.2 PASS ABILITY – When a portion of a public thoroughfare is being utilized for construction purposes, the CONTRACTOR shall maintain as many open lanes as possible for the passage of traffic consistent with safety and good construction practice. Lanes open to traffic shall be managed and maintained free of any debris or material that might affect pass ability and public safety.

When traffic must be limited to the use of only one lane, traffic flow shall be managed so that no undue or unreasonable delays occur. If travel on all lanes of the roadway must be interrupted for an extended period of time, the CONTRACTOR shall first prepare an adequate detour plan and have it approved by the local road or highway department.

02206.3.2.3 ENVIRONMENTAL CONTROL – While using existing roads for construction purposes, the CONTRACTOR shall observe and be responsible for the requirements of Section 01520 with particular regard to dust abatement. When sprinkling with water is being used to control dust, the CONTRACTOR shall make as many passes as are necessary, and as may be directed by the ENGINEER, to keep the creation of dust at a minimum. While sprinkling, the CONTRACTOR shall take particular care to avoid creating slippery or otherwise hazardous conditions on any part of the roadway being used for vehicular traffic.

02206.3.2.4 DRAINAGE – Access and temporary roadways shall give attention to drainage issues.

02206.4 METHOD OF MEASUREMENT

02206.4.1 CONSTRUCTION OF ROADS

Measurement for construction of access roads shall be made by the number of lineal feet of road excavated, compacted and graded to provide either a driveable surface or a base ready for installing gravel surfacing.

02206.4.2 GRAVEL SURFACING

Separate measurement for gravel surfacing shall be made in accordance with Section 02105 for Untreated Base Course.

02206.4.3 TEMPORARY USE OF ROADS

Restoration and resurfacing of roads disturbed or damaged during temporary use for construction shall be included with other items on the Bid Schedule and no measurement or payment for this work shall be made under this specification.

02206.5 BASIS OF PAYMENT

The accepted quantity will be paid for at the contract unit price for:

PAY ITEM	UNIT
Access Road	Lineal Foot

02208.1 DESCRIPTION

Furnish and place flowable fill for backfill in roadway trenches.

02208.1.1 MATERIALS

Cement – Use Portland Cement, Type I or II

Fly Ash – Loss on ignition must be 3% or less.

Fine Aggregate

Natural Sand

Meet the following gradation when test is specified.

Table 02208.1.1	
Sieve Size	Percent Passing
No. 3/4	100
No. 100	0-10

02208.1.2 MIX DESIGN

Meet the following requirements.

Mix design compressive strength (28-day) – between 50 to 150 psi.

Portland Cement – at least 50 pounds/cubic yard

Fly Ash – at least 300 pounds/cubic yard

Slump – 6-10 inches maximum

02208.1.3 FINISH

Finish to a flat surface.

02208.2 METHOD OF MEASUREMENT

02208.2.1 The amount of flowable backfill shall be determined by measuring the lineal feet of trench requiring flowable backfill and accepted as called out in the Contract Documents. No measurement will be given to flowable backfill used in locations not required in the Drawings. Unless called out elsewhere, the measurement will begin and end two feet each side of the existing asphalt surface.

02208.3 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Flowable Backfill	Lineal Foot

02222.1 DESCRIPTION

This section covers furnishing and installation of pipe and fittings of the type, class and size designated for the water system defined on the Drawings, in these Specifications, and elsewhere in the Contract Documents.

02222.1.1 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 15110 - Pipe and Piping Systems
Section 15230 - Waterline Valves and Hydrants
Section 15232 - Water System Control Valves
Section 15234 - Water Service Connections
Section 15236 - Water Main Flow Meters

02222.1.2 SUBMITTALS

02222.1.2.1 MATERIALS AND EQUIPMENT - The CONTRACTOR shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, linings, supports, mechanical restraints, thrust blocks and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall be provided with each delivery of material.

02222.1.2.2 TESTING - As construction proceeds, the CONTRACTOR shall submit test documentation in accordance with this section of these Specifications.

02222.1.3 DEFINITIONS

Fitting - Any component of a pipeline, excluding the pipe itself and valves and meters, which is used for connecting pipe sections; changing line direction or size; connecting meters, valves, tanks, etc.; or starting or terminating pipelines.

Mains - Water distribution pipes, located in streets or rights-of-ways, to which water service connections are made for users of the system.

Run - Any identified section of a pipeline.

Saddle - A fitting placed on a pipe to reinforce the pipe wall, through which a tapping hole is drilled.

Service Lateral - The line which connects to the water meter or to the service stub at the property line extending from there, on private property, to the plumbing at the foundation of a house or business.

Service Stub - The line running from the tap on a main to the meter or to the property line as appropriate.

Tap - The actual connection made to water mains which includes drilling an opening into the main, threading, installing a tapping saddle when appropriate, and installing a valve into the opening.

02222.2 MATERIALS**02222.2.1 PIPE AND FITTINGS**

See Section 15110

02222.2.2 PIPELINE LOCATION IDENTIFIERS

Pipeline location identifiers generally take the form of marker posts, warning tape, and tracer wire.

02222.2.2.1 TRACER WIRE - Unless otherwise described on the plans or herein, the tracer wire shall be an insulated, #12, direct bury copper wire designed and manufactured for this purpose.

02222.2.2.2 WARNING TAPE - The warning tape shall be an inert, plastic, direct bury type with a 2-inch minimum width, of the appropriate safety color, and specifically manufactured for underground utility identification. The tape shall have wording imprinted on it identifying the type of utility it is protecting.

02222.2.2.3 MARKING POSTS - Shall be fiberglass compound, aluminum, or other corrosion resistant metal of 5-foot length and 4 inches wide, or otherwise as shown on the Drawings. They shall be fitted with a deterioration resistant warning notice or label appropriate to the application.

02222.2.3 MISCELLANEOUS FITTINGS AND MATERIALS

02222.2.3.1 POLYETHYLENE ENCASEMENT - Where soil conditions are determined to be severely corrosive and when shown on the Drawings or required in the Contract Documents, tubular polyethylene encasement shall be installed around buried ductile iron piping and fittings in accordance with ANSI/AWWA C-105.

02222.2.3.2 CASING PIPE - Where casing pipe is called for on the Drawings or is required by the ENGINEER, the CONTRACTOR shall furnish and install the casing in accordance with Sections 02315 and 02320 of these Specifications.

02222.2.3.3 PIPE PENETRATION OR CASING SEALS - Where required on the Drawings or in these Specifications, the CONTRACTOR shall furnish and install pipe-to-wall linked rubber seals in core drilled structures, walls, pipe sleeves, or casings in accordance with the manufacturer's instructions. Seals shall be link seals by Thunderline Corporation, or an approved equal.

02222.2.3.4 PIPE RESTRAINTS – Pipe restraints shall be as follows:

- Concrete thrust blocking shall be formed, sized, and placed as described herein and shown on the Drawings. Reinforcing bars used in thrust block construction shall be preformed and fusion bonded epoxy coated.
- Mechanical restraint of piping shall be accomplished with one of the following restraining systems or an approved equal:
 - ⇒ Grooved Ductile Iron AWWA Couplings by Victaulic Company of America (use only with exposed piping systems).
 - ⇒ MEGALUG thrust restraints by EBAA Iron Sales, Inc.

⇒ FIELDLOK restraint gaskets by U.S. Pipe Company. Without the written approval of the Engineer, use of this restraint device is limited to joints in carrier pipe installed in a casing pipe.

All joints of pipe installed under streambeds or canal crossings, or installed in casing pipes, shall be protected with mechanical restraint.

Restraint protection of above ground or exposed piping in buildings or enclosures shall be accomplished only with mechanical restraints.

02222.3 CONSTRUCTION REQUIREMENTS

02222.3.1 HANDLING AND APPROVAL OR REJECTION OF MATERIALS

All materials delivered to and used at the job site are subject to approval of the Engineer or the OWNER. Care shall be taken during handling of pipe, to avoid any impact which might cause damage. Dropping pipe during unloading will not be permitted. Pipe will be carefully inspected in the field before and after laying. If any cause for rejection is discovered in a pipe before or after laying, it shall be removed and replaced by the CONTRACTOR, at no additional cost to the OWNER. Any pipe found to be unfit or rejected due to cracks, broken bells or spigots, irreparable chipped lining, etc., shall be removed from the job site.

02222.3.2 DIAGRAMMATIC LAYOUT

Piping layout on the Drawings shall be considered diagrammatic for all piping not shown with detailed dimensions. When this is the case, pipe size and location are provided, but the Drawings are not intended to show every offset, fitting, or structural difficulty that will be encountered during project construction.

02222.3.3 ALTERATION OF ALIGNMENT

At no additional cost to the OWNER, and with written permission from the ENGINEER, piping alignment may be varied from that shown on the Drawings, to avoid structural or mechanical difficulties, or to avoid the work of other trades. The CONTRACTOR still will be liable to provide all materials and labor required to complete all work in accordance with the best practice of the trade, and to the satisfaction of the ENGINEER.

02222.3.4 INSTALLATION

02222.3.4.1 DEWATERING - Prior to pipe laying and jointing, sufficient dewatering effort shall be provided to maintain the ground water level at or below the surface of the trench bottom or base of the bedding course. The dewatering operation; however accomplished, shall be carried out in such a manner as to not permanently disturb natural underground water conditions.

02222.3.4.2 CONNECTION TO EXISTING FACILITIES - When connections are to be made to any existing pipe or appurtenances, for which the actual elevation or position cannot be determined without excavation, the CONTRACTOR shall excavate for, and expose the existing pipe or appurtenances before laying any new pipe. The ENGINEER shall be allowed to inspect the existing pipe or appurtenances before any connection is made. The CONTRACTOR shall make any adjustments in line or grade which may be necessary to accomplish the intent shown on the Drawings.

Where new fittings, valves, meters, restraints etc., are required to be installed in, or attached to, existing piping, or where connections are to be made to existing piping, the CONTRACTOR shall

furnish and install the necessary components needed to accomplish the work, whether or not specifically indicated on the Drawings.

02222.3.4.3 CAPPING PIPE END - At the close of each workday, or whenever the work ceases for any reason, the end of the pipe shall be securely closed, unless otherwise permitted by the ENGINEER.

02222.3.4.4 JOINING – Joining of pipe shall be as follows:

- When making connections, pipe shall be cut and beveled in a neat and workmanlike manner, so as to provide a smooth, beveled end at right angles to the axis of the pipe. Pipe and fittings shall be assembled so there will be no distortion or springing of the pipelines. Flanges, unions, flexible couplings and other connections shall come together at the proper orientation. The fit shall not be made by springing any piping, nor shall orientation or alignment be corrected by taking up on any flange bolts. Flange bolts, union halves, flexible connectors, etc., shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to fit.
- PVC pipe, 2 inches and smaller in diameter, shall be joined by solvent welding. No disturbance of joints, including from trench backfill operations, will be allowed until solvent welded joints are cured.
- PVC pipe, larger than 2 inches in diameter, shall be joined by means of gasketed joints.
- With bell and spigot joints, care should be taken to properly align the pipe before joints are forced home. Gaskets shall be lubricated in accordance with manufacturer's instructions. During insertion of the spigot end, the pipe shall be partially supported by hand, sling, or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since the most flexible gasketed joints tend to creep apart when the end pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.
- Where fusion of polyethylene pipe joints is required, sections of pipe shall be joined in a continuous length on the job site above ground. Joining shall be by the butt fusion method and shall be performed in strict accordance with the pipe manufacturer's recommendations. Equipment used for butt fusion joining shall be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements, alignment, and fusion pressures.

02222.3.4.5 LAYING - All pipe laid shall be retained in position, using mechanical means if necessary, so as to maintain alignment and joint closure until sufficient pipe bedding and backfill have been completed to adequately hold the pipe in place. All pipe shall be laid to conform to the prescribed line and grade shown on the plans, within specified limits. No blocking of any kind shall be used to adjust the pipe to grade, except when used with concrete embedment. Bedding materials shall be placed so the bottom surface of the pipe will have full bearing for the entire barrel length. The pipe shall rest on not less than 1/4 of its outside perimeter. Bell holes shall be dug as required to assure uniform support along the barrel but shall be no larger than necessary.

Unless otherwise approved by the ENGINEER, pipe shall be laid upgrade from the point of connection on the existing pipeline or from a designated starting point. Pipe shall be installed with the bell end forward or upgrade, unless approved otherwise. When pipe laying is not in progress, the forward end of the pipe shall be kept closed with an approved temporary plug.

02222.3.4.6 PIPE RESTRAINT – Pipe restraint work shall be as follows:

- The CONTRACTOR shall provide and install either concrete thrust blocks or mechanical pipe restraints on all pressure piping not connected with bolted flanges or welded joints.
- For projects involving pipeline construction covered under this section of the Specifications, a pipe restraint schedule is included in the Drawings. Pipe restraints (thrust blocks and/or mechanical restraints) shall be furnished and/or constructed and installed as shown on the Drawings and described in the schedule.
- Pressure pipe shall be properly blocked or restrained at all fittings, wherever the pipeline makes a change in direction of 11.25 degrees or more, wherever it changes sizes, or wherever it ends.
- Placement of concrete thrust blocking shall provide bearing against undisturbed vertical earth banks or approved compacted backfill, sufficient to absorb thrust from line pressure, and in a configuration so that pipe joints and fittings will be accessible.
- All restraints shall be in place before any hydrostatic testing and flushing are performed on the system.
- The CONTRACTOR shall allow visual inspection of every thrust block or mechanical restraint before it is buried.

02222.3.4.7 FINISH BEDDING - After the pipe is laid, additional bedding material shall be placed in 6-inch lifts to a level even with the spring line of the pipe and compacted. The portion of the trench from the spring line to 12 inches above the top of the pipe shall then be filled and compacted in the same way.

02222.3.4.8 REQUIREMENTS FOR INSTALLATION NEAR SEWER LINES - Locate potable water piping at least 10 feet horizontally (measured edge to edge) from any existing or proposed parallel sewer or wastewater leach line. Should conditions prevent the 10-foot separation, upon the ENGINEERs approval the water line may be laid closer than 10 feet to sewer lines (but not leach lines) provided:

- The water line is laid 18 inches above the top of the sewer line, but deep enough to prevent freezing, and
- There is no groundwater impacting the trench, and
- No sewer force main exists, and
- The water line is laid in a separate trench, or
- The water line is laid on an undisturbed earth shelf on one side of the sewer line trench, or

Where potable water lines cross sewer lines, the bottom of the water line shall be at least 18 inches above the top of the sewer line for ten feet on each side of the sewer line, measuring perpendicularly from the water line to the sewer line. When such vertical separation is impossible to achieve, a vertical separation of less than 18 inches may be allowed provided:

- In new construction for both water line and sewer line they shall be constructed of ductile iron pipe or thermoplastic pipe joined by either mechanical or bolted flange joints.

- In situations with an existing sewer line, the new water line shall be constructed as previously described.
- And, when making such crossing, install the water line in such manner that the center of a full length of pipe is on the centerline of the sewer line to isolate the water line joints as far as possible from the sewer line.

02222.3.4.9 EXPOSED PIPING - No exposed piping shall be installed until all equipment to which the pipe is to be attached has been installed and it can be determined where piping and fittings shall be located to make a neat, efficient arrangement. Piping shall be aligned with equipment connections such that no external load or stress will be transferred to any equipment from the piping. Piping shall be installed with a sufficient number of unions, flexible couplings, or flanged joints, in addition to those shown on the Drawings, to allow for convenient inspection and maintenance.

Exposed pipe work shall be suspended or supported, to prevent sagging or over-stressing of the pipe and connections. Assembly of pipe and fittings shall be accomplished so there will be no distortion or springing of the pipe. The fit shall not be made nor the alignment corrected by taking up on any flange bolts. Joints shall come together in proper orientation, and Flange bolts, union halves, flexible couplings, and etc. shall slip freely into place. If the proper fit is not obtained, the piping shall be altered to make the fit meeting the above requirements.

Exposed pipe shall be installed in straight runs parallel to the axis of the structures. Pipe runs shall be horizontal and vertical; except that gravity drain lines shall be pitched down in the direction of flow at a slope not less than 1/8 inch per foot.

All exposed pipe shall be painted in accordance with Section 09910 of these Specifications. Factory finished items are not required to be field painted except touch-up. The color and type of paint used shall be submitted to the ENGINEER for his approval.

02222.3.4.10 DRAINS AND OTHER SYSTEMS - In addition to other requirements in this Section, all irrigation and other lines fitted with drains shall be installed such that continuous slope is maintained to designated drain locations. In areas where there are both culinary water pipelines and irrigation pipelines, exposed portions of irrigation water piping shall be identified by distinctive coloring or other marking. Culinary and irrigation lines and extensions shall be completely separated, installed in separate trenches, and there shall be no cross-connection between the systems under any circumstances.

02222.3.5 SPECIAL CONSIDERATIONS FOR HDPE PIPE

02222.3.5.1 HANDLING AND STORAGE – Polyethylene pipe is able to withstand normal installation handling. However, unusually rough handling of polyethylene pipe can result in damage to the pipe wall. Care shall be taken to avoid pushing or pulling polyethylene pipe over or around sharp projections. Polyethylene pipe is subject to impact damage when dropped from excessive heights or when heavy objects are dropped upon it, particularly during cold weather. Kinking or buckling shall be avoided and any section of pipe which has been damaged in this manner shall be cut out and replaced. If a scratch depth is greater than 10% of the pipe wall thickness, then the section shall be removed and replaced.

02222.3.5.2 FUSION JOINT INSPECTION – The field technique for evaluating a butt fusion joint is bead appearance. The recommended procedures should result in the desired appearance. The CONTRACTOR shall inspect the entire circumference of the fused joint for uniform non-porous bead alignment. Improper fusion shall be redone. The CONTRACTOR shall comply with the Butt Fusion Joint Appearance Guide recommended by the manufacturer.

02222.3.5.3 **PIPE PLACEMENT** – Polyethylene pipe can be joined either above ground or in the ditch as the situation dictates. Though most joining can be accomplished above ground, joining which must be done in the ditch shall be well planned to ensure that enough space is available and that proper alignment is achieved. Care shall be taken to avoid buckling, gouging, and other mechanical damage when lowering polyethylene pipe into the ditch. The pipe should be laid so that there are no bends with a radius less than 20 times the pipe diameter and no joints within 3 feet of any bends. (90 times the pipe diameter at fusions.)

- Align all pipe and fitting joints true to line and grade. Extremely cold weather makes polyethylene pipe stiffer and increases the likelihood of impact damage.
- Because plastic pipe contracts as it cools, it is desirable in hot weather to snake the pipe in the bottom of the trench. This provides for “slack” in the pipeline to be taken up as the pipe cools and contracts in the ditch prior to backfilling. It is recommended that backfilling be accomplished after the pipe has cooled in the shade of the trench.

02222.3.5.4 **HYDROSTATIC LEAK TESTING** – Hydrostatic testing of the HDPE pipeline shall be performed on as many complete sections of the installed pipeline as possible and in the presence of the ENGINEER. Hydrostatic testing procedures shall be as described by “DriscoPlex” Bulletin: PP 802-TN, Test Phase Alternate #1 (www.driscoplex.com). Under no conditions except with the written consent of the ENGINEER shall pneumatic testing be allowed. Pressure recordings and other testing data shall be kept by the CONTRACTOR and supplied to the ENGINEER upon successful completion of the testing procedures.

02222.3.6 **FLUSHING AND CLEANING**

02222.3.6.1 **FLUSHING WITH WATER** - Prior to proceeding with pressure testing (and/or disinfection if required) of completed lines, the CONTRACTOR shall fill the test section with clean, potable water and flush the lines. The CONTRACTOR shall furnish all equipment and labor to complete the flushing as required by this section. Water for flushing shall be provided by the OWNER.

02222.3.6.2 **DIFFICULT CONTAMINANTS** - Certain contaminants, especially in caked deposits, resist flushing at any velocity. If, in the opinion of the ENGINEER, such contaminants have entered the line during construction, the interior of the pipe shall be swabbed, as necessary, to remove the debris prior to proceeding with flushing.

02222.3.6.3 **MINIMUM FLUSHING FLOW AND VELOCITY** - The CONTRACTOR shall make all arrangements, to establish a minimum 2.5 feet per second (fps) flow velocity in the line during the flush. Flushing shall proceed until the installed pipe is free of debris. The flows needed to produce the required flushing velocity indicated above are provided in the table below.

FLUSHING FLOW AND VELOCITY

Pipe Diameter (inches)	Flow (gpm) to Produce 2.5 fps
4	100
6	200
8	400
10	600
12	900
16	1600

NOTE: With 40 psi residual pressure, 2 1/2 inch and 4-1/2 inch hydrant outlet nozzles will have the ability to discharge approximately 1,000 GPM and 2,500 GPM respectively.

02222.3.7 TESTING

The CONTRACTOR shall perform all testing, and shall furnish all materials, equipment, and labor necessary to complete this work as required. Any work that fails to meet the acceptance criteria of prescribed testing shall be repaired and/or replaced at no additional cost to the Owner. All repaired work shall be re-tested. This sequence shall be repeated until the work meets the acceptance criteria.

02222.3.7.1 PRESSURE TESTING - All pipelines constructed for carrying potable, non-potable, and water-borne products shall be pressure tested for leakage when they are completely assembled, unless directed otherwise in these Specifications or in writing by the ENGINEER.

WARNING - The hydrostatic test procedures described herein are not applicable to air pressure testing.

Prior to pressurization all required flushing shall have been completed. Pipeline sections to be tested shall be isolated from any connecting lines. Air release taps shall be provided at points of highest elevation, the test section shall be filled with clean potable water, and all air shall be removed from the line. Pressure on the test section shall then be brought to full test pressure and maintained at that level for a period of not less than 4 hours. Pipelines shall be tested at 50 psi over normal static pressures shown on the Drawings or to the manufacturer’s class rating, which ever is lower. Permanent plugs shall be inserted into the air release tap holes after the test has been completed.

02222.3.7.2 LEAKAGE TESTING - The leakage test shall be conducted concurrent with the pressure test. Amount of leakage, if any, will be determined by measuring the quantity of additional water required to maintain the prescribed hydrostatic pressure test during the test period. Accurate means shall be provided to measure the quantity of water required to maintain full pressure on the line for the 4-hour test period, the measured leak rate shall not exceed the rate "L" computed as follows:

$$L = SD(P^{0.5})/133,200$$

where: L = Leakage rate (gal/hour)
 S = Length of tested pipe (feet)
 D = Nominal diameter of pipe (inches)
 P = Average test pressure (psi)

When the allowed amount of leakage is exceeded, leaks shall be located and repaired and the system shall then be re-tested by the CONTRACTOR until compliance is achieved.

All visible leaks in exposed pipe shall be repaired.

02222.3.7.3 OPERATIONAL TESTING (*pressurized irrigation only*) - Pressurized irrigation systems shall be tested for proper system operation after backfill is in place and sprinkler heads have been adjusted to final position. This test shall demonstrate that the system meets coverage requirements (based on operation of one circuit at a time) and that all automatic controls function properly.

02222.3.7.4 NON-RIGID PIPE DEFLECTION TESTING - At the ENGINEER’s request, the CONTRACTOR shall test requested portions of all non-rigid pipe after being installed and backfilled to ensure that circumferential deflection does not exceed 5% of the diameter. Such test will consist of passing a mandrel through an open section of pipe, sized appropriately to detect non-compliance. The mandrel shall be sized in accordance with the requirements provided in Section 02224 for checking sewer pipe. In the event deflection non-compliance is found, the

CONTRACTOR shall make repairs as outlined in Section 02224 and additional testing of other sections of pipe will be requested.

02222.3.7.5 TESTING DOCUMENTATION - The CONTRACTOR shall maintain a record of all testing performed, together with the test results obtained, for each line installed under this Contract. Minimum information to be included in these records shall be as follows:

- All Documents:
 - Date of issuance of the record
 - Name of Contract
 - CONTRACTOR's name and address

- Disinfection Report:
 - Name and address of treatment supervisor
 - Disinfection method used
 - Location and boundary description of section to be disinfected
 - Time and date of disinfectant introduction
 - Time and date of disinfectant release
 - Initial disinfectant residual (PPM) for each outlet tested
 - Time and date of flushing after disinfection
 - Signature of treatment supervisor (signifies completion of disinfection activities)

- Bacteriological Report:
 - Date issued
 - Project name and location
 - Laboratory's name, certification number, address and phone number
 - Test location
 - Time and date of sample collection
 - Name of person collecting sample
 - Time and date of laboratory test start
 - Coliform bacteria test results for each sample
 - Certification that water conforms (or fails to conform) to bacterial standards of the appropriate state public drinking water regulations
 - Bacteriologist's signature

- Test Report:
 - Type of test
 - Location of test
 - Sizes, types, and lengths of pipe in test section, and test boundary description
 - Date and Time test started
 - Date and Time test completed
 - Test pressure (*Pressure Test only*)
 - Amount of leakage/allowable leakage (*Pressure Test only*)
 - Mandrel dimensions (*Obstruction and Non-Rigid Pipe Deflection Tests only*)
 - Test result (*pass/fail*) (*All Tests*)
 - Printed Name/Signature and Date of Test Supervisor (CONTRACTOR's representative) (*All Tests*)
 - Printed Name/Signature of Inspector (ENGINEER's representative) witnessing and approving the test (*All Tests*)

02222.3.8 DISINFECTION

02222.3.8.1 REGULATORY COMPLIANCE - All pipelines to be used for culinary water service shall be disinfected in accordance with the requirements of state and local public drinking water regulations.

02222.3.8.2 METHODS - The CONTRACTOR may use any method which complies with the above referenced standards; however, the “slug method”, prescribed in ANSI/AWWA C-651, is preferred. This method basically consists of filling the line with potable water and then injecting a “slug” of concentrated chlorine solution (100 mg/L) at the upstream end of the line. The “slug” is then moved through the line by slowly draining the low end. When properly conducted, this procedure provides contact to the interior pipe surfaces with a heavily concentrated dose of chlorine to achieve disinfection.

02222.3.8.3 FLUSHING - After disinfection, the lines shall be flushed until residual chlorine is reduced to the levels safe for consumption. Samples for bacteriological testing can then be taken. The CONTRACTOR shall safely and legally dispose of contaminated water used for disinfection after consultation with the local authorities. Under no circumstances shall heavily chlorinated water be allowed to mix with “live” waters, meaning waters in lakes, rivers, streams or wetlands.

02222.3.9 PIPELINE LOCATION IDENTIFIERS

The CONTRACTOR shall furnish and install such identifiers as shown on the Drawings and/or prescribed in these Specifications.

02222.3.9.1 TRACER WIRE – Tracer wire shall always be installed in the trench with non-metallic pipelines, during or immediately following their installation and may be required in the installation of metallic pipelines where electric conductance is necessary and is not provided through the pipeline because of its type of construction. Tracer wire placement shall be as shown on the Plans but shall generally be immediately beneath (preferred), to the side, or above the pipeline with approximately 4 inches of separation. Tracer wire shall be brought to the surface of the ground at all valves and risers and where otherwise shown on the Plans.

Tracer wire shall be installed as shown in the Plan details. Where splices in the wire are required, the CONTRACTOR shall use the manufacturer recommended splice nut (cap) to provide a watertight joint. Extend electrical tape well over the wire insulation in all directions.

The CONTRACTOR shall provide all necessary labor, equipment, and materials to perform an electrical continuity test prior to acceptance on all installed tracer wire. The test shall be performed in the presence of the ENGINEER or an appointed representative. The continuity test shall be conducted using an ohmmeter. Continuity must be demonstrated to pass the test. In the event of a failed test, the CONTRACTOR shall make all necessary repairs required to provide a tracer wire system that complies with the testing requirements of this section.

Some soil conditions and/or installation circumstances may require the additional installation of cathodic protection for the tracer wire. When this is the case, cathodic protection will appear as a separate bid item and details for its installation will appear on the Plans and elsewhere in these Specifications.

02222.3.9.2 WARNING TAPE – A continuous ribbon of warning tape shall be installed during the backfill operation. Tape shall be placed a minimum of 12-inches above the top of the pipeline or at a depth approved by the ENGINEER, or otherwise as shown on the drawings. At roll ends and at places where the tape has been broken, the loose ends shall be tied together to prevent separation during the rest of backfill.

02222.3.9.3 **MARKING POSTS** – Marking posts shall be installed at the placement intervals shown on the Plans. Posts shall not be deformed or damaged during installation. The CONTRACTOR shall use a post hole digger to install markers when there is danger of damage to posts from pounding or hammering

02222.3.10 **CLEANUP**

Following acceptance of testing and completion of backfilling and surface restoration, the CONTRACTOR shall prepare the work for Contract Closeout in accordance with Section 01200 of these Specifications.

02222.4 METHOD OF MEASUREMENT

02222.4.1 **BURIED WATER LINES**

The amount of buried water line pipe shall be determined by measuring the lineal feet of pipe in place and accepted, including the lengths of fittings, valves, couplings, and portions of pipe within casings, unless called out otherwise in the Contract Documents.

Measurement of lines passing through, or connecting to control valves or other operating devices enclosed in vaults or manholes, shall be made only up to the pay limit of the enclosure or vault as shown on the Drawings. If no pay limit is shown, measurement will be made to a point five (5) feet outside of the enclosure.

Measurement of ductile iron pipe shall include polyethylene encasement where that material is required.

02222.4.2 **PIPELINE LOCATION IDENTIFIERS**

Measurement of tracer wire and location markers installed with non-metallic pipe shall be included in the measurement of the waterline pipe unless they are separate bid items in which case measurement for tracer wire shall be the same as the length of waterline installed and location markers shall be measured by counting the number of markers installed.

02222.4.3 **EXPOSED PIPELINES**

Exposed water pipe shall not be measured in connection with the installation of water lines but shall be included in the measurement of the structure or facility where the exposed pipe is located, and payment for such pipe shall be included in the payment for those bid items.

02222.4.4 **FITTINGS**

Unless specifically called out for separate payment on the Bid Schedule, fittings for pipelines and piping systems will be considered appurtenant to the line or system being installed, and measurement for such fittings will be included in the measurement for that pipeline or piping system.

02222.4.5 **MISCELLANEOUS**

Separate measurement for valves and vaults and enclosures and their contents will be as described in other sections of these Specifications.

02222.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
<i>(size)</i> PVC Pipe (<i>Class</i>) [AWWA C-900] or [<i>Pressure rated</i>]	Lineal Foot
<i>(size)</i> DI Pipe (<i>Class</i>)	Lineal Foot
<i>(size)</i> HDPE Pipe [IPS] or [DIPS] C906 SDR (#)	Lineal Foot
<i>(size)</i> Galvanized Iron Pipe (<i>Schedule</i>)	Lineal Foot
Pipeline Location Markers	Each

No separate payment will be made for fittings unless called for on the Bid Schedule.

02250.1 DESCRIPTION

This section describes the construction and installation of clay cutoff walls in trench excavations to inhibit the movement of groundwater and/or to prevent the drainage of wetlands or other surface water features following backfill.

02250.1.1 RELATED WORK

Not Used.

02250.1.2 DEFINITIONS

Not Used.

02250.2 MATERIALS

Clay used for construction of the clay cutoff wall shall be "pit run bentonite" and shall exhibit a permeability of 1×10^{-6} cm/sec.

02250.3 CONSTRUCTION REQUIREMENTS

The CONTRACTOR shall furnish and install clay cutoff wall for backfill in trenches where influenced by groundwater. The clay cutoff wall shall act as a flow curtain to stop groundwater piping in trenches and along pipelines.

02250.3.1 INSTALLATION

Clay cutoff wall shall be installed the total trench width from the bottom of the trench to 2 feet above groundwater static level or finished grade, whichever is lower. Clay cutoff walls shall be a minimum of 3 feet thick. Clay cutoff walls shall be constructed at each end of the water bearing portion of a trench excavation and at intermediate intervals not to exceed 400 feet where groundwater exists

02250.3.2 COMPACTION

Material shall be compacted to 90% maximum density. Proctors shall be taken for materials used, furnished by the CONTRACTOR's independent geotechnical testing laboratory, or by the supplier of approved clay.

02250.3.3 PIPE BEDDING

Clay shall be used to bed pipe, and shall be installed as specified herein for "pipe bedding".

02250.3.4 FINISH

Finished grade and surface improvements over clay cutoff walls shall be as specified herein and shown on the drawings.

02250.4 METHOD OF MEASUREMENT

Measurement for this bid item shall be made by counting the number of completed and accepted clay cutoff walls installed in the project.

02250.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Clay Cutoff Wall	Each

02500.1 DESCRIPTION

This work includes removal and restoration of existing features, public or private, including but not limited to asphalt or concrete pavement, concrete structures, curb and gutter, sidewalk, gravel surfacing, driveways, crosswalks, landscaping, field crops, irrigation ditches, fences, culverts, buried or exposed utilities, abandoned utilities, small utility buildings and the disposal of resulting waste materials and debris.

02500.1.1 RELATED WORK

Section 01510 - Protection of Existing Improvements
Section 02015 - Clearing and Grubbing
Section 02200 - Trench Excavation and Backfill
Section 02511 - Hot Plant Mix Bituminous Surfacing
Section 02520 - Pavement Cutting
Section 02900 - Landscaping

02500.1.2 SUBMITTALS

When any improvement not owned by the OWNER is designated for restoration work, then, upon completion of such restoration, the CONTRACTOR shall obtain a written statement of acceptance or release from the responsible owner of the feature. This statement, in turn, will be submitted to the ENGINEER for his review and approval prior to acceptance of the work for payment.

02500.1.3 DEFINITIONS

Not used.

02500.2 MATERIALS**02500.2.1 GENERAL**

When restoration of a feature is indicated in the Contract Documents, such work shall be accomplished so as to restore the feature to its original, or better, condition and/or function as it existed prior to removal.

It is recognized that exact duplication of materials cannot always be achieved, but reasonable effort is expected from the CONTRACTOR to restore the feature with materials which will provide the same or better service and appearance as observed prior to removal.

All materials shall be new.

02500.2.2 BITUMINOUS SURFACE**02500.2.2.1 PRIMER OR TACKER COAT** – Shall be an approved bituminous material such as type MC-70-250, SS1, or CS-1.**02500.2.2.2 PATCHING AND REPAIR** - Plant mix material that meets or exceeds the requirements of Section 02511 herein, or of the local State Department of Transportation for asphalt surface road repair, shall be used for patching and repair.**02500.2.2.3 SURFACING** – Shall be hot or cold mix bituminous surfacing, meeting or exceeding the requirements of Sections 02511 or 02512 herein, or of the local State Department of Transportation for asphalt surface road repair.

02500.3 CONSTRUCTION REQUIREMENTS

02500.3.1 UNCLASSIFIED REMOVAL AND RESTORATION

02500.3.1.1 EXISTING IMPROVEMENTS - All existing facilities disturbed by the CONTRACTOR in prosecution of the Work, including but not limited to asphalt or concrete pavement, concrete structures, curb and gutter, sidewalk, gravel surfacing, driveways, crosswalks, landscaping, field crops, irrigation ditches, fences, culverts, buried or exposed utilities, abandoned utilities, small utility buildings or any other structures or obstructions designated to be removed on the Drawings, by the ENGINEER, or these Specifications, shall be removed, cleaned up, and then restored or replaced in kind by the CONTRACTOR in new condition.

02500.3.1.2 ADJACENT IMPROVEMENTS - Care shall be exercised in such removal to assure that adjacent facilities or structures, which are to remain, are not disturbed. Any damage to such existing facilities or structures resulting from carelessness or negligence on the CONTRACTOR's part shall be satisfactorily restored to new condition at the CONTRACTOR's expense.

02500.3.1.3 VEGETATION - Trees, shrubs, and other landscape plants designated to be saved for replanting shall be carefully removed, bundled, set aside and protected for replanting by the CONTRACTOR. Turf Sod to be saved for replanting shall be removed by machine cutting. In lieu of removal and replacement of turf sod or field crops, the CONTRACTOR may, upon approval of the property owner, remove and replant the same. Such agreements shall be documented on the final property release to be signed by the property owner.

Replanting of landscape items shall be performed in accordance with Section 02900.

02500.3.2 TOPSOIL

02500.3.2.1 REMOVAL AND PROTECTION - In all construction areas where re-growth of vegetation is desired, and when called for by the Contract Documents, the CONTRACTOR shall remove, segregate, stockpile, store, and protect topsoil during excavation in accordance with Section 02900. Topsoil shall be kept free from contamination from foreign materials and other soils. The CONTRACTOR shall arrange construction activities to avoid damage or disturbance to the stockpiled soil.

02500.3.2.2 REPLACEMENT - When backfill operations have been completed, the topsoil shall be replaced and restored to the original contours or as called for on the Drawings, in accordance with Section 02900 of these Specifications.

02500.3.3 GRAVEL SURFACE

02500.3.3.1 REMOVAL - When restoration of graveled driveways, roadways, or parking areas is required, the existing gravel surfacing shall be graded off and stockpiled safely away from ongoing work activities, to prevent contamination with subsurface materials. It may then be reapplied and compacted during restoration activities.

02500.3.3.2 RESTORATION - Areas to be restored shall be backfilled and graded to uniform lines and compacted to the density prescribed for trenching in Section 02200. Existing gravel surfacing materials shall then be replaced in uniform 3 inch layers compacted to 95% of maximum density. After compaction, the affected area shall be graded smooth. Sufficient new material of equal or better quality shall be applied and mixed in, to replace materials lost during prosecution of the Work, to ensure a 3-inch minimum gravel cover after compaction and grading.

02500.3.4 BITUMINOUS SURFACE

02500.3.4.1 REMOVAL - Bituminous pavement surface shall be removed and restored in accordance with this paragraph unless provisions for restoration are made in other Sections of these Specifications. The pavement surface, public or private, designated for removal shall be removed to neat lines, which shall be cut in accordance with Section 02520. No ripping or rooting will be permitted outside of the limits of the cut lines.

Existing driveways, sidewalks, etc., which do not match the new finish grade as shown on the Drawings, also shall be removed preparatory to restoration work.

02500.3.4.2 DISPOSAL - Surfacing materials removed shall be disposed of in accordance with Section 01520 of these Specifications, and will not be permitted in the backfill, except as specifically authorized by the ENGINEER and in accordance with local requirements.

02500.3.4.3 RESTORATION – Restoration of bituminous surface shall proceed according to the following steps:

- First, the sub-grade shall be graded to a uniform surface, and 6 inches of Untreated Base Coarse (UBC) gravel shall be placed over the area in lifts not thicker than 3 inches, compacted to 95% of its maximum density.
- Then, the exposed edges of existing pavement shall be primed with a material approved for this purpose.
- Unless shown otherwise on the drawings or required otherwise by the ENGINEER, hot or cold mix bituminous surfacing shall be spread and compacted in individual, 3-inch maximum lifts over the base course. Minimum thickness of the new bituminous surfacing layer shall be equal to the adjacent surface thickness, but shall be not less than 3 inches thick when compacted to 95% of its maximum density.
- Rolling operations shall be conducted in such a manner that shoving or distortion will not develop beneath the roller. The surface shall be finished to a smooth, uniform line and grade with surface deviations not exceeding plus or minus 1/4 inch in 10 feet, unless the surface is subject to more stringent State, County, or Municipal requirements. The determination of smoothness compliance may be made with a straight edge or string line at the option of the ENGINEER. Any irregularities shall be satisfactorily corrected at the sole expense of the CONTRACTOR.
- Existing driveways, sidewalks, etc., which were removed because they did not match the new finish grade, shall be replaced and restored to their original or better condition to match the new finish grade shown on the Drawings, or as directed by the ENGINEER.

02500.3.5 REMOVAL AND RESTORATION OF CONCRETE IMPROVEMENTS.

02500.3.5.1 REMOVAL - Existing concrete pavement in streets, alleys, driveways, sidewalks, etc., public or private, shall be cut in accordance with Section 02520, and removed to the lines indicated on the Drawings, or as directed by the ENGINEER. No ripping or rooting will be permitted outside of the limits of saw cut lines.

Existing driveways, sidewalks, etc., which do not match the new finish grade as shown on the Drawings, also shall be removed preparatory to restoration work.

02500.3.5.2 DISPOSAL - All materials removed shall be disposed of in accordance with Section 01520 of these Specifications, and will not be permitted in the backfill, except as specifically authorized by the ENGINEER and in accordance with local codes.

02500.3.5.3 RESTORATION - Sub surface preparations shall be the same as those in paragraph 02500.3.4.3 above.

- Concrete pavement including sidewalks, driveways, roadways, and parking area surfacing shall be replaced by the CONTRACTOR in accordance with Division 3 of these Specifications, unless otherwise directed by the ENGINEER
- Those existing driveways, sidewalks, etc., which were removed because they did not match the new finish grade, shall be replaced and restored to their original or better condition to match the new finish grade shown on the Drawings, or as directed by the ENGINEER.
- All other concrete improvements shall be restored in accordance with details shown on the Drawings, or as directed by the ENGINEER, and as required by the provisions of Division 3 of these Specifications.

02500.3.6 REMOVAL AND RESTORATION OF FENCES

When necessary to remove any fence to facilitate its operation, the CONTRACTOR shall obtain prior agreement with the owner of the fence for its removal. Temporary containment measures shall be provided, if needed, at no additional expense to the OWNER. As soon as practical, the permanent fence shall be restored to its original condition or better.

02500.3.7 RESTORATION OF IRRIGATION DITCHES

Restoration of irrigation ditches shall be made in such a manner that the ditch configuration and size will be equivalent to its original condition and the ditch will be located on its original alignment. Any embankment required to restore the original slope of the ditch will be layer compacted with mechanical compaction equipment to 90% of maximum dry density determined by AASHTO T-99.

02500.3.8 CLEANUP

Areas of construction activity shall be left in a condition of uniform grade, blending into pre-existing contours and concealing, as much as possible, evidence of construction activity by back dragging or raking to conceal tire marks. Cleanup and disposal of surplus materials shall be performed in accordance with Section 01520.

02500.4 METHOD OF MEASUREMENT

02500.4.1 NO BID SCHEDULE LINE ITEM

When the Bid Schedule in the Contract does not contain a line item for "Removal and/or Restoration of Surface Improvements", then this work will be considered incidental to other items included in the Bid Schedule, and no separate measurement shall be made for this work.

02500.4.2 "DESIGNATED AREA" LINE ITEM

Measurement for removal and/or of surface improvements in a designated area shall be the "lump sum" of the work required to remove and properly dispose of materials resulting from removal.

**REMOVAL AND REPLACEMENT OF
SURFACE IMPROVEMENTS****SECTION
02500**

02500.4.3 “DESIGNATED FEATURE” LINE ITEM

Measurement for removal and/or restoration of designated features shall be per unit as described in the Bid Schedule.

02500.4.4 BITUMINOUS SURFACE PAY LIMIT

Measurement for bituminous surface removal and replacement shall be made by multiplying the pay limit by the actual length of removal and replacement in lineal feet as determined using a tape measure or other accurate measuring device.

In general, for pipe trench excavation, the pay limit shall be determined by the formula $W = OD + 18$ inches (pay limit width equals pipe outside diameter plus 18 inches), rounded up to the nearest standard bucket width. Actual measurement may be modified according to information indicated on the Drawings or as directed by the ENGINEER.

The pay limit for removal of bituminous surface for other purposes shall be as shown on the Drawings or directed by the ENGINEER.

02500.4.5 DAMAGED ITEMS

Measurement of items damaged or removed as a result of the CONTRACTOR’s negligence shall not be allowed and no payment will be made under this contract.

02500.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit prices as follows:

PAY ITEM	UNIT
Removal of Site Surface Improvements	Lump Sum
Removal of <i>(Name of Structures)</i>	Each
Removal of Sidewalk	Square Yard
Removal of Fences	Lineal Foot
Removal of Driveway Slabs	Square Yard
Removal of Curb and Gutter	Lineal Foot
Removal of Bituminous Surface	Square Yard
Replace <i>(Name of Structure)</i>	Each
Replace <i>(Thickness)</i> Sidewalks	Square Yard
Replace <i>(Thickness)</i> Driveway Slabs	Square Yard
Replace <i>(Thickness)</i> Bituminous Surface	Square Yard
Replace <i>(Description)</i> Fence	Lineal Foot
Replace <i>(Description)</i>	Lineal Foot or Lump sum
Restore <i>(Description)</i>	Lineal Foot or Lump Sum

02510.1 DESCRIPTION

This section covers all sampling and testing of subgrade and pavement materials. The materials sampling and testing shall be done by an independent certified testing company and all testing reports shall be submitted to the ENGINEER within a reasonable time period.

02510.1.1 RELATED WORK AND REFERENCED SECTIONS

Section 02200 – Trench Excavation and Backfill
Section 03050 – Portland Cement Concrete

02510.1.2 SUBMITTALS

All sampling and test reports shall be submitted in accordance with Section 01300.

02510.1.3 DEFINITIONS

Not used.

02510.2 MATERIALS

Not used.

02510.3 CONSTRUCTION REQUIREMENTS

02510.3.1 TESTING

The minimum testing requirements are as follows: All Materials sampling and testing shall be done by an independent certified testing company and all testing reports shall be submitted to the ENGINEER within a (2) two week time period or sooner.

02510.3.1.1 EMBANKMENT

- Maximum Laboratory Density 1 test in each soil type
- Field Density and Moisture 1 test per 2000 square yards

02510.3.1.2 BACKFILL

- Field Density and Moisture 2 tests per culvert or structure
(Refer to Section 02200 for Trench Excavation and Backfill Testing)

02510.3.1.3 UNTREATED BASE COURSE

- Sieve Analysis 1 test per production day
- Maximum Laboratory Density 1 test per 10,000 tons
- Field Density and Moisture 1 test per 2000 square yards

02510.3.1.4 ASPHALT CONCRETE PAVEMENT

- Mix design (ASTM 1559 and AASHTO T-283) 1 mix design for the project
- Asphalt temperature As necessary to assure compliance
- Gradation and Asphalt Content 2 tests per production day
- Field Density 1 test per 1600 square yards

- Mix and Laydown Temperature As necessary to assure compliance
- Thickness 1 test per 1600 square yards

02510.3.1.5 PORTLAND CEMENT CONCRETE

- Slump Test 1 test per load of concrete
- Air Test 1 test per load of concrete
- Strength Test 1 compressive strength per 50 cubic yards

02510.4 METHOD OF MEASUREMENT

Measurement for this pay item will be by the lump sum.

02510.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price:

PAY ITEM	UNIT
Materials Sampling and Testing	Lump Sum

02890.1 DESCRIPTION

This work shall consist of installing only, or furnishing and installing delineators, signs, sign supports, panels and posts or removing and disposing of existing signs, posts and hardware.

02890.1.1 RELATED WORK

Section 02005 – Traffic Control

02890.1.2 SUBMITTALS

Not used.

02890.1.3 DEFINITIONS

Not used.

02890.2 MATERIALS

02890.2.1 TRAFFIC CONTROL SIGNS

Traffic control sign details not shown on the Drawings shall meet the requirements of the Manual of Uniform Traffic Control Devices issued by the U.S. Department of Transportation. Requirements for temporary signs used for traffic control during construction are provided in Section 02005 of these Specifications.

02890.2.1.1 SIGN PANELS

02890.2.1.2 PANELS – All panels shall be of one-piece construction made from plywood, sheet steel or sheet aluminum, as shown in the Schedule of Items. All panels shall have the face side reflectorized.

02890.2.1.3 PLYWOOD PANELS – Plywood panels shall be exterior Type B-B, high-density overlay, 60/60 with black overlay on both sides, 3/4-inch 7 ply or 1/2-inch 5 ply thick, Douglas fir plywood or better, meeting the requirements of the National Bureau of Standards PS-1, current edition or as shown on the Drawings. Other overlay colors may be used provided the back of the panel is printed with two heavy coats of black paint.

Paint used shall be ready-mixed, exterior type, polysilicone alkyd resin base enamel, Benjamin Moore No. 120-60 (Federal Color Chip No. 20059), or approved equal.

02890.2.1.4 ALUMINUM PANELS - All aluminum sheet or plate used for panels shall meet the requirements of ASTM B-209, alloy 6061-T6 or 5052-H38 and shall be of the thickness prescribed below, unless otherwise shown on the Drawings.

SHEET ALUMINUM REQUIREMENTS

Sign Width (Inches)	Sheet Aluminum Thickness (Inches)
Less than 8	0.022
8-12	0.040
13-19	0.063
20-30	0.080
31-48	0.100
over 48	0.125

- 02890.2.1.5 **STEEL PANELS** - The finished plate for steel panels shall be free of twist or buckle, and the background shall be substantially a plane surface. The finished sign panel shall be of continuous coat mill-galvanized phosphate coated steel.
- 02890.2.2 **SIGN POSTS**
- 02890.2.2.1 **POSTS** - Posts shall be wood, aluminum, steel or other material as specified.
- 02890.2.2.2 **WOOD POSTS** - Wood posts shall be construction grade or better Douglas Fir or graded pine, and shall conform to the grading and dressing rules of the Western Wood Products Association. Wood posts shall be cut to size before treatment and shall be of the dimensions shown on the Drawings. Unless otherwise specified, posts shall be incised before treatment as a means of improving penetration of the preservative. Wood posts shall be pressure treated in accordance with AASHTO M-133 and/or the Uniform Building Code for Posts and also in compliance with the standards of the American Wood Preservers Association.
- 02890.2.2.3 **STEEL POSTS** - Steel posts shall meet the requirements of ASTM A-299, galvanized in accordance with AASHTO M-111. Minimum weight per foot will be as shown on the Drawings.
- The posts shall have 7/16-inch holes drilled or punched, before galvanizing, along the centerline of the web. The punching or drilling should begin 1-inch from the top of the post, at 2-inch centers for the upper 5-feet of the post.
- 02890.2.2.4 **ALUMINUM POSTS** - Aluminum posts shall be standard shapes as shown on the Drawings and shall be aluminum alloy 6061-T6 or 6351-T5, meeting the requirements of ASTM B-221.
- 02890.2.3 **FITTINGS**
- Lag screws, washers, clip angles, wood screws, shear plates, U-bolts, clamps, bolts, nuts and other fasteners shall be galvanized steel, cadmium-plated steel, aluminum alloy or as shown on the Drawings. Galvanizing of steel hardware shall be in accordance with AASHTO M-232. High-strength steel bolts, nuts and washers shall meet the requirements of ASTM A-325, except as shown in the Drawings.
- 02890.2.4 **REFLECTIVE MATERIALS TYPE II AND TYPE III REFLECTIVE SHEETING**
- All reflective materials (sheeting, legend, borders and symbols) shall conform to the "Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects," FP, current edition and Federal Specification L-S-300C. Colors shall be as specified in the MUTCD and enclosed drawings. No more than 12 months shall elapse from the date of manufacture to the date of application on the substrate.
- 02890.2.5 **CHARACTERS, SYMBOLS, AND COLORS**
- 02890.2.5.1 **CHARACTERS, SYMBOLS, AND BORDERS** - Letters, numerals, arrows, symbols, border and other features of the sign message shall be of the type, size and series shown on the Drawings.
- 02890.2.5.2 **COLORS** - Colors shall be as specified in MUTCD or shown on the Drawings. Completed letters, numerals and other units shall be formed to provide continuous stroke width with smooth edges and shall present a flat surface free of warp, blisters, wrinkles, burrs and splinters. Units of the sign message of the type shown on the Drawings shall meet the following requirements:
- 02890.2.5.3 **SCREEN PROCESS APPLICATION (type L-1 Screen Process)** - The letters, numerals, arrows, symbols and border shall be applied on the reflective sheeting or opaque background of the sign

by direct or reverse screen process. Messages and borders of a color darker than the background shall be applied to the paint or the reflective sheeting by direct process. Message and borders of a color darker than sign field shall be produced by the reverse screen process.

- Opaque or transparent colors, inks and paints used in the screen process shall be of the type and quality recommended by the manufacturer of the reflective sheeting.
- The screening shall be done in a manner that results in a uniform color and tone, with sharply defined edges of legend and border and without blemishes on the sign background that will affect intended use.
- After screening, signs shall be air dried or baked in accordance with manufacturer’s recommendations to provide a smooth, hard finish. Any signs on which blisters appear during the drying process shall be rejected.

02890.2.5.4 **DIRECT APPLICATION** (type L-3 Direct Applied Characters) - The letters, numerals, symbols, border and other features of the sign message shall be cut from Types II or III reflective sheeting of the color specified in MUTCD or shown in the Drawings and applied to the reflective sheeting of the sign field in accordance with the instructions of the manufacturer of reflective sheeting.

The reflective sheeting shall have minimum reflective intensity (candelas per Foot-candle) as shown below:

MINIMUM REFLECTIVE INTENSITY			
Entrance Angle	White	Yellow	Red
0°	115	70	30
20°	20	25	12

02890.2.6 **DELINEATORS**

The materials to be used for the delineator assembly shall be as shown on the Drawings. The reflectors shall be amber or crystal and ready for mounting. Supporting posts shall be steel, aluminum, wood or other material as shown on the Drawings.

02890.3 CONSTRUCTION REQUIREMENTS

02890.3.1 **FABRICATION OF SIGN PANELS**

All panel fabrication, including cutting, punching and drilling of holes, shall be completed prior to final surface preparation and application of reflective sheeting, except where required for the fabrication of die-cut or sawed letters on processed and mounted signs. Metal panels shall be cut to size and shape and shall be free of buckles, warp, dents, cockles, burrs and defects resulting from fabrication. The surface of all sign panels shall be flat.

Field drilling of holes in any part of the structural assembly will not be permitted without the approval of the Engineer.

02890.3.2 **PANELS**

02890.3.2.1 **ALUMINUM PANELS** - Aluminum sign panels shall be fabricated from standard widths of aluminum sheet. The blanks shall be cleaned, degreased and chromated or otherwise properly prepared in accordance with approved methods recommended by the sheeting manufacturer.

- 02890.3.2.2 **STEEL PANELS** - The panels shall be cleaned, degreased or otherwise prepared in accordance with approved methods recommended by the sheeting manufacturer.
- 02890.3.2.3 **PLYWOOD PANELS** - The face of the plywood panel shall be abraded, cleaned and degreased in accordance with approved methods recommended by the manufacturer of the reflective sheeting. The edges of the plywood panel shall be sealed with 2 mil dry film thickness (in 2 coats); one coat shall be applied before application of reflective sheeting, the other, after.
- 02890.3.2.4 **DURABILITY TREATMENT** - After all reflective sheeting legend has been applied, sign panels with Type II sheeting shall be recycled in the heat and vacuum applicator for 2 minutes at a temperature of approximately 190°F under 21-inches of vacuum. When the sign panel has cooled, the top edge of each sign shall be covered with a clear 3-inch wide polyester film with a sun-resistant, pressure-sensitive adhesive that does not turn yellow under exposure to ultraviolet radiation. Scotchcal Brand Film #639 or Engineer approved equal shall be used. Film shall be applied in lengths of 24-inches. Where more than one piece is required, film shall be applied from each corner of the top edge toward the center of the top edge. End overlap of 2-inches or more shall be required where one film piece joins another piece.
- 02890.3.3 **DELINEATOR POSTS AND HOUSING**
- Delineator posts shall be driven at locations and to the depth shown on the Drawings. The delineator housing shall be attached to the post in accordance with the manufacturer's direction.
- 02890.3.4 **SIGN ERECTION**
- 02890.3.4.1 **SUPPORTS** - Sign supports shall be erected plumb and in accordance with the details shown on the Drawings and in a manner consistent with the U.S Department of Transportation's "Manual of Uniform Traffic Control Devices" to reduce glare.
- 02890.3.4.2 **FASTENING PANELS** - The sign panels shall be securely fastened to the posts as shown on the Drawings.
- 02890.3.5 **SIGN REMOVAL**
- Sign assemblies to be removed shall be shown on the Drawings. Where signs are to be replaced, signs shall be removed just before the installation of replacement signs. All sign materials removed shall become the property of the Contractor. Posts shall be removed to a minimum of 3-inches below natural ground line. Post holes remaining shall be backfilled with suitable material and compacted.
- 02890.4 METHOD OF MEASUREMENT**
- 02890.4.1 Measurement for signs shall be made by (1) counting the number of signs in place and accepted or, (2) by using a tape measure to determine the square footage of panels and the lineal footage of posts (nominal dimensions for wood materials), as shown in the Bid Schedule. No deduction will be made for rounded corners.
- 02890.4.2 Measurement for sign removal shall be made by counting the number of sign assemblies removed and disposed of as listed in the Bid Schedule. An assembly shall be considered as one sign when its materials are integrally connected at a single location.

02890.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price for each pay item shown in the Schedule of Items:

PAY ITEM	UNIT
Wood Posts (<i>Size</i>)	Lineal Foot
Steel Posts (<i>Size</i>)	Lineal Foot
Aluminum Posts (<i>Size</i>)	Lineal Foot
Aluminum Sign Panels (<i>Size or Description</i>)	Square Foot
Plywood Sign Panels (<i>Size or Description</i>)	Square Foot
Steel Sign Panels (<i>Size or Description</i>)	Square Foot
Delineators	Each
Sign (<i>Description or Identification</i>)	Each
Sign Removal (<i>Description</i>)	Each
Sign & Post(s) Installation Only	Each

02900.1 DESCRIPTION

This section covers providing materials, equipment and labor necessary for installing topsoil, turf, trees, shrubs, grasses, forbs, field seeding, re-seeding, fertilizer, mulch, and soil amendments.

02900.1.1 RELATED WORK

Not used.

02900.1.2 SUBMITTALS

The Contractor shall submit for approval product data and seed mixtures in accordance with the requirements of Section 01300.

02900.1.3 DEFINITIONS

Not used.

02900.2 MATERIALS**02900.2.1 TOPSOIL**

Topsoil shall be obtained from local sources, and shall have similar soil characteristics to those of the soil at the location where it is to be used. Topsoil shall be obtained from well-drained sites where it occurs to a depth of not less than 4 inches, and it shall not be obtained from bogs or marshes. Topsoil shall be fertile, friable, natural loam, reasonably free of subsoil, clay lumps, brush, weeds, litter, roots, stumps, stones larger than 2 inches in any dimension, or any other material which would inhibit the germination of seeds or the growth of the cover crop.

02900.2.2 TURF SEED

If not otherwise required in the Contract Documents, seed for turf sod shall be composed principally of Kentucky bluegrass (*Poa pratensis*), testing 99.9% pure live seed (PLS), or as approved. Other acceptable varieties include Merion, Baron, Fylking, Tall Fescue, and Brome.

02900.2.3 TURF SOD

Turf sod shall be vigorous, viable, strongly rooted sod, not dormant or less than 2 years old, free of weeds, undesirable native grasses, insect infestations, and fungus. It shall be machine cut to a pad thickness of 1 inch (\pm 0.33 inch).

02900.2.4 TREES AND SHRUBS

02900.2.4.1 NURSERY GROWN - Trees and shrubs shall be nursery-grown, with botanical and common names of plants true to the approved names given in the latest edition of "Hortus", and shall meet the requirements of the American Standard for Nursery Stock adopted by the American Association of Nurserymen. Plants shall be sound, healthy, vigorous, symmetrically proportioned, well branched, densely foliated when in leaf, free of disease, insect pests, eggs, and larvae and shall have well developed root systems.

02900.2.4.2 ROOT BALLS AND PRUNING - Root balls shall be protected at all times from sun, drying winds and frost. Plants shall not be pruned prior to delivery. If balled and burlapped plants are not installed immediately upon delivery, they shall be set on the ground and protected with moist soil or wet mulch.

02900.2.4.3 **WARRANTY** - Trees and shrubs shall be warranted for a period of 1 year after Substantial Completion, against death and unsatisfactory growth, except in cases resulting from OWNER's neglect, abuse by others or natural phenomena. Unacceptable plant material shall be replaced at end of warranty period. Only one replacement is required.

02900.2.4.4 **FIELD SEED MIX**

The seed mix listed below is suggested as a standard for field seeding when no other information is available. However, seed mix requirements can vary widely from area to area, and the CONTRACTOR shall contact the local office of the Natural Resources Conservation Service (NRCS) to obtain an appropriate seed species mix and application rate for the location in question. The CONTRACTOR shall follow the directions of the NRCS, the ENGINEER, and the property owner in doing field seeding.

SUGGESTED FIELD SEED MIX

Species	Amount (%)
Nardan Crested Wheatgrass	30
Russian Wild Rye	20
Y.B. Sweet Clover	15
Slender Wheatgrass	10
Oahe Intermediate Wheatgrass	10
Fairway Crested Wheatgrass	5
Western Wheatgrass	4
Other	6

02900.2.5 **RESEEDING AND REVEGETATING**

As with the field seed mix, non-field seed mix and/or vegetation requirements are usually area sensitive. Different government agencies, such as the Forest Service or the Bureau of Land Management, may have separate seed mix and vegetation requirements within the same area. The CONTRACTOR shall contact the respective property owner at their local office, address, or telephone number to obtain the appropriate reseeding and revegetating requirements and follow the same, in concurrence with the ENGINEER, in acquiring the appropriate seed and vegetation.

02900.2.6 **MULCH**

02900.2.6.1 **TREE AND SHRUB MULCH** - Tree and shrub mulch shall consist of well-aged fibrous or shredded bark, old sawdust, pine needles or leaf mold.

02900.2.6.2 **FIELD SEED MULCH** - Field seeding mulch shall be certified weed free small grain straw or native hay.

02900.2.6.3 **HYDRAULIC MULCH** - Hydraulic seeding mulch shall consist of pigments and wood cellulose fiber or paper pulp and shall form a blotter-like ground cover with moisture absorption and percolation properties. It shall have the ability to cover and hold the seed in contact with the topsoil, yet not inhibit the penetration of seedlings through it.

02900.3 CONSTRUCTION REQUIREMENTS

02900.3.1 **SCOPE OF REQUIREMENTS**

The CONTRACTOR shall furnish all equipment, labor, topsoil, seed, seed mixes, turf, shrubs trees or other materials required to landscape, re-seed, or re-vegetate all areas disturbed by the

Work, as required by the Drawings and these Specifications. The disturbed area shall be kept as small as possible.

02900.3.2 **EROSION CONTROL**

The condition of landscaped, re-seeded and re-vegetated areas shall be checked to determine the effectiveness of erosion control methods and materials. Checks will be made upon project completion, at three months following project completion, and at nine months following project completion. Any modifications or repairs required by the ENGINEER shall be promptly performed by the CONTRACTOR, at no additional cost to the OWNER.

02900.3.3 **TOPSOIL**

02900.3.3.1 **REMOVAL OF TOPSOIL** - Topsoil to be saved shall be carefully removed to a depth of 24 inches, or to the actual depth of the existing layer, which ever is less, and set aside in a separate location. It shall not be mixed with the remainder of excavated material.

02900.3.3.2 **REPLACEMENT OF TOPSOIL** - When site work conditions permit, topsoil shall be spread as shown on the Drawings. The minimum depth of topsoil shall be 6 inches over all designated areas. Topsoil shall be fine graded to a firm even surface, matching existing slopes, with no lumps or stones present. The topsoil shall be prepared to a good condition, not muddy or hard, and shall be scarified to a friable condition if it is hard before turf is placed.

02900.3.3.3 **PROTECTION AGAINST EROSION** - Areas where topsoil has been spread shall be protected against erosion.

02900.3.4 **TURF SEED**

02900.3.4.1 **SEEDBED PREPARATION** - Where required, turf seed shall be installed as specified herein. Seedbed preparation shall be accomplished by spreading peat moss or manure uniformly at a rate of 3 cubic yards per 1,000 square feet and worked into the soil by light tilling.

02900.3.4.2 **APPLICATION** - Seed shall be applied at a rate of 2 pounds per 1,000 square feet using a drop (band) type spreader unless otherwise approved by the ENGINEER. The seed shall be divided into two halves and then distributed, half in north/south directions and half in east/west directions. Seed shall be raked into the soil, a layer of mulch shall be applied, and then lightly watered, at least four times daily for two weeks, or until the seed germinates.

02900.3.5 **TURF SOD**

02900.3.5.1 **INSTALLATION** - Where required, turf sod shall be laid across slopes such that butt joints alternate. Sod pieces shall be fitted tightly together so no joint is visible and then firmly and evenly hand tamped. The sod shall then be rolled with a 150-pound roller to level and seal all seams.

02900.3.5.2 **WATERING** - After rolling, sod shall be watered until water soaks into underlying topsoil to a depth of not more than 3 inches. For grades of 50% slope or steeper, the sod shall be secured with wooden pegs driven flush with the soil portion of the sod and 2 feet maximum on center.

02900.3.5.3 **MOWING** - Prior to Substantial Completion, sod shall be mowed as required to maintain a maximum height of 2 1/2 inches.

02900.3.6 **TREES AND SHRUBS**

- 02900.3.6.1 LOCATION - When required trees and shrubs shall be installed, as specified herein, at locations designated on the Drawings. Trees and shrubs to be saved and replanted shall be carefully removed, set aside, protected and preserved until they can be safely replanted.
- 02900.3.6.2 PREPARATION OF PLANTING PIT - Tree and shrub pits shall be five times the diameter of the root ball. The bed shall be prepared by loosening the soil with a tiller or shovel to a depth of 12 inches. Topsoil and organic matter shall then be added and distributed uniformly within the planting bed as necessary. The CONTRACTOR shall not proceed with planting until the pit locations and bedding are approved by the ENGINEER.
- 02900.3.6.3 PLANTING - The plant shall be set in the center of a hole of the proper size, plumb and straight. Burlap, ropes and all wire and other materials shall be removed, and then the excavated soil shall be returned to the hole and gently packed around the root ball. The planting shall be flooded with water to promote additional soil consolidation. The CONTRACTOR shall give care that, after settling, the top of the root collar shall be even with the adjacent finished grade. A 2-inch layer of mulch shall be applied around the base of the tree, to extend 2 feet in radius beyond the root ball.
- 02900.3.6.4 SUPPORT - Trees shall be guyed with two wires anchored securely to steel posts not less than 5 feet from the trunk, and directly opposite each other. The trees shall be protected from direct contact with the wires.
- 02900.3.6.5 PRUNING - Each plant shall be pruned with clean, sharp tools, to remove suckers and broken, badly bruised or dead branches. Tree trunks shall be wrapped with Tubex or equivalent translucent material unless directed otherwise by the ENGINEER.
- 02900.3.6.6 WATERING - Trees and shrubs shall be watered and maintained until Substantial Completion and defective work shall be corrected as soon as it becomes apparent and as weather and season permit.
- 02900.3.7 FIELD SEEDING
- Field seeding shall be accomplished using one of the following methods.
- 02900.3.7.1 BROADCAST - Broadcast seeding shall only be applied after October 15 and prior to April 15, unless authorized otherwise and directed in writing by the ENGINEER. No seed bed preparation will be required for this seeding method.
- 02900.3.7.2 DRILLING - Drilling shall be set forth in uniform rows with spacing not to exceed 8 inches and the depth set correctly for the type of seed being drilled. The minimum distribution rate shall be 20 pounds per acre, and may be more if so recommended by the local Soil Conservation Service.
- 02900.3.7.3 HYDRAULIC - For hydraulic seeding the CONTRACTOR shall use equipment designed for such work. Seed and water shall be uniformly applied to the areas scheduled to be seeded. Fertilizer, water and approximately 1 ton per acre of hydraulic mulch shall be homogeneously mixed and uniformly applied to seeded areas.
- 02900.3.8 RESEEDING AND RE-VEGETATING
- 02900.3.8.1 RE-SEEDING - Reseeding of areas disturbed by the Work shall be accomplished with grasses compatible with the pre-construction vegetation. The CONTRACTOR shall consult the local office of the U.S. Forest Service, Bureau or Land Management, Soil Conservation Service, or other applicable affected agency, for appropriate seed species and application rates. Unless otherwise directed by the ENGINEER or these Specifications, reseeding shall be accomplished by broadcast seeding in accordance with this section.

02900.3.8.2 RE-VEGETATING - Re-vegetation of areas disturbed by the Work shall be accomplished with started trees and shrubs, compatible with the pre-construction vegetation, and is performed in addition to reseeding as discussed in paragraph 02900.3.8.1 above. When re-vegetation is required, the CONTRACTOR shall consult the local office of the applicable affected agency, for appropriate species and instructions.

02900.3.9 MULCH

Mulch shall be incorporated as prescribed on the Drawings and in these Specifications. Where the slope exceeds 10%, the CONTRACTOR shall use a tie down mulching material.

02900.4 METHOD OF MEASUREMENT

02900.4.1 LUMP SUM - Lump sum measurement for landscaping shall include all grading, soil preparation, planting, furnishing materials and plants in accordance with the Drawings and these Specifications when shown as a single item in the Bid Schedule.

02900.4.2 SEPARATE MEASUREMENT - When and if applicable, separate measurements for topsoil, turf seeding, turf sod laying, reseeding, re-vegetating, mulching and planting of trees and shrubs shall be made in the units shown and as identified in the Bid Schedule.

02900.5 BASIS OF PAYMENT

The accepted quantity(s) shall be paid for at the contract unit price for:

PAY ITEM	UNIT
Landscaping	Lump Sum
Topsoil	Square Yard
Turf, Seed	Square Foot
Turf Sod	Square Foot
Trees & Shrubs	Each
Field Seeding	Acre
Re-seeding	Acre
Mulch	Acre

02950.1 DESCRIPTION

This section covers furnishing and installation of geotextile fabric of the type and configuration shown on the Drawings or specified in the Contract Documents.

02950.1.1 RELATED WORK

Section 02200 - Trench Excavation and Backfill
Section 02201 - Earthwork for Structures
Section 02202 - Roadway Excavation and Embankment

02950.1.2 SUBMITTALS

The CONTRACTOR shall submit manufacturer's descriptive literature, which identifies and describes applications, physical properties and characteristics of geotextile filter fabric materials to be used for this contract, in accordance with Section 01300 of these Specifications. Upon request of the ENGINEER, the CONTRACTOR shall supply samples for examination or testing.

02950.1.3 DEFINITIONS

Not used.

02950.2 MATERIALS**02950.2.1 FOR RIPRAP AND DRAINAGE CHANNELS**

Unless shown otherwise on the Drawings or in Contract Documents, filter fabric materials for installation under riprap in drainage channels, or for lining structural footing drainage components shall be TREVIRA Spunbond type 011/250, MIRIFI 180/N or an approved equal with the following characteristics:

FILTER FABRIC CHARACTERISTICS

Grab Tensile Strength, ASTM D-4632	210 lb.
Elongation at Failure, ASTM D-4632	50%
Trapezoid Tear Strength, ASTM D-4533	75 lb.
Puncture Strength, ASTM D-4833	95 lb.
Mullen Burst Strength, ASTM D-3786	360 psi.
Permeability - k, ASTM D-4491	0.3 cm/sec.
Permittivity, ASTM D-4491	1.4 sec ⁻¹
Vertical Water Flow, ASTM D-4491	110 gpm/ft ²
Apparent Opening Size*, ASTM D-4751	0.210 mm

*Maximum Opening Size

02950.2.2 FOR EMBANKMENTS AND FOUNDATIONS

Requirements for geotextile fabric materials used for embankment or foundation stabilization other than that specified above will be provided in the Special Provisions of the Contract Documents.

02950.3 CONSTRUCTION REQUIREMENTS

Filter fabric materials shall be installed in strict accordance with the manufacturer's instructions and recommendations. Care shall be taken at all times to prevent puncturing or tearing of the fabric materials during placement under embankment or riprap materials. Joints of fabric sheets shall be lapped in accordance with the manufacturer's instructions and fastened securely in place with fasteners to prevent gaps and misalignment during coverage with earth materials.

02950.4 METHOD OF MEASUREMENT

02950.4.1 Geotextile fabrics will be considered incidental to installation of riprap and drainage gravel envelopes and no separate measurement shall be made.

02950.4.2 When shown separately as an item in the Bid Schedule, geotextile fabric shall be measured to the nearest tenth square yard determined from field measurements of surface areas on which each type of the fabric is installed, excluding overlaps.

02950.5 BASIS OF PAYMENT

02950.5.1 When geotextile fabric materials are furnished and installed incidental to other items in the Bid Schedule, no separate payment shall be made.

02950.5.2 When shown in the Bid Schedule as a separate item, the accepted quantities will be paid for at the contract unit price for:

PAYMENT ITEM	UNIT
Geotextile Fabric (<i>Type</i>)	Square Yard

DIVISION 3

CONCRETE



03050.1 DESCRIPTION

This section contains requirements for Portland cement concrete materials and concrete mix designs.

03050.1.1 RELATED MATERIALS AND WORK

Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slabwork
Section 03500 - Pre-Cast Concrete Components
Section 03600 - Grout and Mortar

03050.1.2 SUBMITTALS**03050.1.2.1 PROPOSED MIX DESIGN** - Each proposed mix design shall be submitted at least 14 days prior to its use in the Work. Indicate whether mix has been designed for pumping. Mix design submittals shall include the following information:

- Water-cement ratio.
- Proportion of materials in the mix.
- Source and type of cement.
- Analysis of water to be used, unless potable.
- Type and name of admixtures applied. Indicate when accelerating or retarding admixtures are to be used and the resulting change in placement times.
- Slump, air content, and temperature of samples.
- Unit weights of fresh and dry light weight concrete.
- Any applicable and verifiable test documentation available if the submitted mix design has been used by the CONTRACTOR in prior projects.

03050.1.2.2 AGGREGATE TEST REPORT - Aggregate Test Report (submit for each aggregate source):

- Data of test analysis.
- Sieve analysis.
- Organic impurities.
- Sodium sulfate soundness test.
- Reactivity of aggregate.
- Complete identification of source of aggregate.

03050.1.2.3 CHANGES IN MIX DESIGN - After the design of the mix or mixes has been approved by the ENGINEER, neither the source, character, or grading of the aggregate, nor the brand or type of cement shall be changed, without 48 hours written notice to the ENGINEER. Should such changes become necessary, no concrete containing such new or altered materials shall be placed until the revised mix design has been submitted to the ENGINEER for review and approval.**03050.1.3 DEFINITIONS**

Workability - The ease of placing, consolidating and finishing freshly mixed concrete.

Consolidation - Hand rodding or mechanically vibrating actions which give freshly mixed concrete the characteristics of a thick fluid so as to minimize voids when set.

Hydration - The chemical reaction between water and calcined limestone resulting in the excellent bonding properties of the cement particles with one another and with the aggregates in the mix.

Curing – Synonymous with the hydration reaction. May be enhanced by procedures which assure the retention of sufficient moisture to allow the reaction to go as far to completion as possible.

Strength - The maximum resistance of a mortar or concrete specimen to axial compressive loading expressed in psi.

Admixtures - Chemical additives to concrete mixes intended to adjust setting time, reduce water demands, increase workability and entrain air.

Air Entrainment - Introduction of chemicals to concrete mixtures which produce microscopic air bubbles which improve the workability and ability to resist deterioration due to freezing.

Reinforcement - Materials formed or mixed in concrete mixtures, to increase the ability of the concrete to withstand loading when set (hardened).

Water-Cement Ratio - The weight of the water divided by the weight of the cement in a concrete mixture.

Tempering - The addition of water to mixed concrete after arrival on site.

03050.2 MATERIALS

03050.2.1 CEMENT

03050.2.1.1 **SITE-PLACED CONCRETE** - For site-placed concrete, cement shall be Type II (low alkali) cement, meeting requirements of ASTM C-150, unless otherwise directed by the ENGINEER or these Specifications. Do not use cement containing lumps, or cement which has partially set. Do not mix cements originating from different sources or manufacturers.

03050.2.1.2 **PRE-CAST CONCRETE** - For pre-cast concrete, cement shall be Class 5000 (minimum) in accordance with ACI 318 for units to be installed above ground. For units installed below ground, concrete shall be Class 4000 in accordance with ASTM C 478 and ASTM C 858.

03050.2.2 WATER

Shall be potable or water which meets the requirements of AASHTO T-26.

03050.2.3 REINFORCEMENT

Shall be in accordance with Section 03200 of these Specifications.

03050.2.4 ADMIXTURES

03050.2.4.1 **AIR ENTRAINMENT** - Air entrainment of concrete shall meet the requirements of AASHTO M-154 (ASTM C-260).

03050.2.4.2 **PLASTICIZERS** - Water reducing agents (plasticizers) and set retarding agents shall meet the requirements of AASHTO M-194 (ASTM C-494). Only types A or F will be approved as water reducing agents and only types D or G will be approved as set retarding agents. Water reducing agents and set retarding agents shall be pre-measured and added in strict accordance with manufacturer's instructions. Calcium chloride will not be approved.

03050.2.4.3 FLY ASH - Pozzolan (fly ash) may be used to replace a percentage of cement in the mix design in accordance with ASTM C-618, under the following conditions:

- The minimum required cement content shall be expressed in the design formula before replacement calculations are made.
- The amount of Portland cement replaced by pozzolan shall not exceed 15% for exterior concrete (concrete exposed to weather) and 20% for interior concrete.
- The ratio of replacement by weight of pozzolan to cement shall be 1.25 to 1.0.
- Loss of ignition of pozzolan shall be less than 3 percent, and the water requirement shall not exceed 100 percent.
- All other requirements of this Section still apply.
- Mix designs including trial batches are required for each aggregate source and for each concrete class.
- See also Subsection 03050.2.6.4 below.

03050.2.5 AGGREGATE

03050.2.5.1 AGGREGATE RATIO - The combined weight of coarse and fine aggregate material passing the No. 200 sieve shall not exceed 1.75 percent of the total weight of aggregate. The ratio of coarse to fine aggregate shall not be less than one (1) nor more than two (2), nor shall the amount of coarse aggregate be great enough to cause difficulty in concrete placement or honeycombing in the structure.

03050.2.5.2 COARSE AGGREGATE - Coarse aggregate shall comply with AASHTO M-80, using gradations from the following table:

COARSE AGGREGATE GRADATIONS

Aggregate Size	Percent Passing (by weight)							
	Sieve Size							
	2½"	2"	1½"	1"	¾"	½"	3/8"	No. 4
2" to No. 4	100	95-100		35-70		10-30		0-5
1½" to No. 4		100	95-100		35-70		10-30	0-5
1" to No. 4			100	95-100		25-60		0-10
¾" to No. 4				100	90-100		20-55	0-10

Maximum coarse aggregate gradation shall not be larger than 1/5 of the narrowest dimension between sides of forms; shall not be larger than 1/3 the depth of slabs; shall not be larger than 3/4 of the minimum clear distance between reinforcing bars or between bars and forms, whichever is less; and shall not be larger than 2 inches.

The maximum percentage by weight of deleterious substances allowed in coarse aggregate materials shall be:

**DELETERIOUS SUBSTANCES ALLOWED IN COARSE
AGGREGATE**

Substance	Percent
Soft fragments	2.0
Coal and lignite	0.3
Clay lumps	0.3
Other deleterious substances	2.0

03050.2.5.3 FINE AGGREGATE - Fine aggregate shall comply with AASHTO M-6 using gradations from the following table:

FINE AGGREGATE GRADATIONS

Sieve Size	Percent Passing (by weight)
3/8-inch	100
No. 4	95 to 100
No. 16	45 to 80
No. 50	10 to 30
No. 100	2 to 10

The maximum percentage by weight of deleterious substances allowed in fine aggregate shall be:

DELETERIOUS SUBSTANCES ALLOWED IN FINE AGGREGATE

Substance	Percent
Coal and lignite	0.3
Clay lumps	0.5
Other deleterious substances	2.0

03050.2.5.4 AGGREGATE SOUNDNESS AND REACTIVITY - As determined in accordance with ASTM C-88, potentially deleterious aggregates shall not be used unless service records have shown the aggregates to be innocuous, and the ENGINEER subsequently approves them in writing.

03050.2.6 MIXING REQUIREMENTS

03050.2.6.1 CONCRETE CLASSIFICATIONS - Mixing requirements for the specific concrete classes indicated on the Drawings and/or within these Specifications shall be as follows:

CONCRETE CLASSIFICATIONS

Concrete Properties	Concrete Classifications		
	5000	3500	2000
Coarse Aggregates (see requirements shown below)			
Maximum Water/Cement Ratio (gal/sack)	5.0	6.5	8.0
Minimum Cement Content (sacks/CY)	***	6.0	4.5
Slump (inches)**	2 to 4	2 to 4	2 to 5
Air Content (percent)	5.0 to 7.5	5.0 to 7.0	3.0 to 5.0
Required Average 28 Day Compression Strength Test (psi)****	5200	3700	2200
Required Minimum 28 Day Compression Strength Test (psi)****	4800	3300	1800

Notes: * All concrete installed shall be Class 3500 unless otherwise required in the Contract Documents.
 ** When water reducing agents are not used.
 *** Cement content shall be appropriate to produce a mixture meeting the requirements for water/cement ratio and workability for the specific job conditions.
 **** One compressive strength test shall consist of the average strength of two cylinders in the test sample.

03050.2.6.2 **REQUIRED AVERAGE DAY COMPRESSIVE STRENGTH** - The CONTRACTOR shall furnish and install concrete that will produce a Required Average (28) Day Compressive Strength as shown on the table above. The average of any three consecutive (28) day strength tests shall not fall below the required Minimum (28) Day Compressive Strength Test shown. If the average of any three consecutive tests falls below the Required Minimum, the average strength of the concrete shall be increased at the Contractor's expense by increasing the cement content.

03050.2.6.3 **WATER REDUCING AGENTS** - When water reducing agents (plasticizers) are used in the concrete mixtures shown above, maximum slump requirements may be increased to 5 inches with low range water reducers and to 8 inches with high-range water reducers.

03050.2.6.4 **FLY ASH** - When fly ash is used in the mix, the cement in the water/cement ratio denotes the cement and fly ash combined. Cement shall be introduced into the batcher before the fly ash.

03050.2.6.5 **CONCRETE PLACED IN WATER** - For concrete deposited in water, add one additional bag of cement per cubic yard more than the design requires for concrete placed above water.

03050.3 CONSTRUCTION REQUIREMENTS

03050.3.1 **STORING CEMENT**

Bagged and bulk cement shall be stored in weatherproof enclosures to exclude moisture and contaminants.

03050.3.2 **STOCKPILING AND HANDLING AGGREGATE**

03050.3.2.1 **CLEAN SITE** - The site provided for stockpiling aggregates shall be clean with adequate space to provide separate stockpiles for coarse and fine aggregates.

03050.3.2.2 **WASHING AGGREGATE** - Washed aggregates shall be allowed to drain to a uniform moisture content, and stockpiles shall be built at least 48 hours before use.

03050.3.2.3 **HEIGHT** - Aggregate shall not be dropped more than 10 feet from the conveyor, nor shall cone shaped piles more than 10 feet high be built.

- 03050.3.2.4 STOCKPILE LAYERING - Stockpiles shall be built in thin layers (5 feet maximum) in such manner, to prevent spillage of aggregate over the sides of the stockpile.
- 03050.3.2.5 FROZEN MATERIALS - Stockpiles containing snow, ice, or frozen materials shall not be used.
- 03050.3.3 BATCHING MATERIALS
- 03050.3.3.1 SCALES - The CONTRACTOR shall provide scales or arrange for usage of scales that have been certified by State agencies within the past 12 months.
- 03050.3.3.2 BATCH MIXERS - Batch mixers shall be operated at the manufacturer's recommended drum speed. Drums and blades shall be kept free from excessive cement and mortar build up. Cement shall be introduced into the batcher before fly ash, and all admixtures shall be introduced to the mixer separately.
- 03050.3.3.3 CENTRAL MIXING PLANT - At central mix plants, all materials shall be mixed for at least 80 seconds at recommended drum speed. When more water is added to the cement mixture, the materials shall be mixed for an additional 30 seconds.
- 03050.3.3.4 MIXING PERIOD - The mixing period for truck mixers shall be maintained between 70 and 100 revolutions at mixing speed. Maintain a minimum of 90 revolutions for front end discharge trucks. Concrete mixing shall be completed before the truck leaves the batch plant yard.
- 03050.3.3.5 WATER REDUCING AGENTS - If water reducing agents are added at the site, they shall be added using injection equipment capable of rapidly and uniformly distributing the admixture. Prior to discharge, the concrete shall be mixed for a minimum of 5 minutes at a drum rate not less than 12 rpm or more than 15 rpm discharge.
- 03050.3.4 HEATING AGGREGATE AND WATER
- 03050.3.4.1 HEATING EQUIPMENT - When approved by the ENGINEER, the CONTRACTOR, at its own expense, may provide and operate heating equipment to heat aggregate and water because of cold weather conditions. All heating operations shall meet temperature limitations provided in these Specifications and shall conform to Standard ACI 306. The CONTRACTOR shall ensure that excessive heat does not cause "flash set" when the cement is added.
- 03050.3.4.2 UNIFORM HEATING - Aggregates shall be heated uniformly with steam or dry heat. Water shall be heated to between 70°F and 150°F when introduced into the mixer. Measures shall be taken to prevent overheating and hot spot development. No combustion products (ash, smoke, gas, etc.) shall contact the aggregate.
- 03050.3.5 COOLING CONCRETE MIXTURE
- 03050.3.5.1 COOLING EQUIPMENT - When approved by the ENGINEER, the CONTRACTOR, at its own expense, may provide and operate equipment to refrigerate water, provide ice or cool aggregate, to mix concrete due to hot weather conditions. All methods of cooling shall meet the requirements of ACI 305.
- 03050.3.5.2 USE OF ICE - When ice is introduced into the mixer, it shall be in such form as to be completely melted and dispersed throughout the mix at the completion of the mixing time. The mixing time shall be held to the minimum practicable, consistent with producing concrete meeting the specified requirements.
- 03050.3.6 CONCRETE TRANSPORT

03050.3.6.1 TRUCKS - Concrete mixtures shall be transported only in conventional transit mixers or agitator trucks with rating plates that are readable. Trucks shall be equipped with visible water meters and revolution counters and shall be capable of measuring all water introduced into the mixing drum.

03050.3.6.2 LOADING - Trucks shall not be loaded:

- In excess of their rated mixing capacity, or
- In excess of 63 percent of the drum gross volume, or
- In quantities less than 2 cubic yards

03050.3.7 CONCRETE TEMPERING

03050.3.7.1 ADDING WATER – Concrete may be tempered through the addition of water under the following conditions:

- Water shall be added within specified time limits. At no time shall water be added after testing has taken place.
- Wherever possible, water shall be added after the truck leaves the batch plant.
- Water shall not be added in excess of the water/cement ratio or in excess of that specified on the batch tickets.
- The mixing drum shall be rotated at least 30 revolutions at the manufacturer's recommended mixing speed when water is added, OR, addition of water for tempering shall be followed by 3 minutes of mixing at mixing speed prior to discharge.
- Water shall not be added after 1/2 cubic yard or more of concrete has been discharged from the drum.

03050.3.7.2 LOW SLUMP - When concrete arrives at the site with a slump below specification, the CONTRACTOR may temper the mix up to the maximum approved water/cement ratio, provided:

- The mix design allows for on-site water addition;
- The amount of water added is accurately measured to the nearest gallon;
- The maximum slump is not exceeded; and
- The person adding water is approved to do so by the ENGINEER and the concrete supplier.

03050.3.7.3 TEMPERING WITH PLASTICIZER - Do not deliver concrete containing plasticizer to the site unless the batch delivery ticket displays water/cement ratio prior to plasticizer addition. Tempering with plasticizer after delivery time window expiration shall not be allowed.

03050.3.8 CONCRETE PLACEMENT

Shall be in accordance with Section 03300.

03050.3.9 CONCRETE SAMPLING AND TESTING

03050.3.9.1 **PROCEDURE** - Tests for slump, air entrainment, strength and temperature by an independent certified testing facility shall be provided by the CONTRACTOR. Independent test facility can be changed by ENGINEER at any time. Sampling and testing will be performed at the expense of the CONTRACTOR and as directed by the ENGINEER.

03050.3.9.2 **SAMPLING FREQUENCY** - Concrete sampling frequency shall be as noted below:

- A minimum of one air test (ASTM C-231) and one slump test (ASTM C 143) shall be performed for each placement over 5 cubic yards. At least one air and one slump test shall be performed for each additional load of concrete placed.
- For each test, the concrete temperature and the time shall be verified and recorded. Air and slump test results shall be recorded on batch delivery tickets.
- If an air test fails, immediately retest the same load. The concrete shall be rejected if the second air test fails to meet specified requirements. If the second air test meets specified requirements, a third test will be performed to establish concrete acceptance or rejection.
- If the slump for an individual load cannot be corrected by tempering within the mix design requirements and within the requirements of these Specifications, the load shall be rejected.
- The testing facility shall prepare test cylinders for strength testing in accordance with ASTM C-31 & ASTM C-39.
- At least one strength test shall be performed for each placement over 5 cu. yd., and one additional test for every 50 cu. yards of concrete placed or more frequently at the ENGINEER's discretion. Three cylinders shall be prepared for each test. One cylinder from each test may be set aside at the CONTRACTOR's request for strength verification prior to form removal. The average compressive strength of two cylinders constitutes one compressive strength test.
- The CONTRACTOR shall provide space in the work area and protect sample cylinders from disturbance for 24 hours after they are cast or until they are moved from the work area by testing laboratory personnel or under the direction of the ENGINEER.
- The average compressive strength shall meet the requirements shown in the table in Section 03050.3.1 for the class of concrete placed.

03050.4 METHOD OF MEASUREMENT

Measurement for concrete placed in accordance with these Specifications shall be as described in Section 03300.

03050.5 BASIS OF PAYMENT

Acceptable quantities of concrete, when measured separately, shall be paid for at the contract unit prices described in Section 03300.

03100.1 DESCRIPTION

Includes furnishing materials, accessories and labor required to form, finish and cure interior and exterior cast-in-place concrete.

03100.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03200 - Concrete Reinforcement
Section 03300 - Concrete Structures and Slabwork
Section 03500 - Precast Concrete Components
Section 03600 - Grout and Mortar

03100.1.2 SUBMITTALS

03100.1.2.1 SHOP DRAWINGS - When called for in these Specifications, the CONTRACTOR shall furnish shop drawings of forms for specific concrete items. Such drawings shall show general construction of forms, jointing, location of ties and other items affecting visibility.

03100.1.2.2 FORM RELEASE AGENT - Where concrete surfaces are scheduled to receive special finishes or applied coverings, which may be affected by the form release agent, submit manufacturer's instruction for use of agent.

03100.1.2.3 CHEMICAL HARDENER - Submit name, type, chemical analysis and manufacturer's recommended rate of application for chemical hardener, when specified.

03100.1.2.4 CURING COMPOUNDS - Submit manufacturer's specifications, test information, ingredients, certification, and installation recommendations for curing compounds. This information may become the basis of acceptance or rejection of the work cured by the material used. See also the submittal requirement under Membrane Curing Compounds in 03100.3.6.2 herein

03100.1.3 DEFINITIONS

Shoring - The framework installed to support formwork.

Re-Shoring - Framework installed or not removed which serves as support for form-work after concrete sets and there is less need for the support.

Form Coatings - Compound coated on forms, preventing concrete surface bonding to the forms.

Curing Compound - Liquid medium sprayed or coated on concrete to retain moisture.

03100.2 MATERIALS**03100.2.1 FORM TIES AND SPREADERS**

Shall be removable or snap-off metal, designed to prevent form deflection and to prevent spalling concrete surfaces upon removal. Form ties shall be factory fabricated. Field fabricated ties will not be acceptable. The portion of the tie remaining within concrete after removal of exterior parts should be 1 inch below the outer concrete surface, and the remaining hole in the concrete surface shall not be larger than 1 inch diameter, unless approved otherwise by the ENGINEER.

03100.2.2 JOINT FILLER

Shall be furnished and installed in accordance with Section 03310 herein.

03100.2.3 FORM RELEASE AGENTS

Commercial formulation form release agent compounds shall be used. Form release agents shall not bond with, stain or adversely affect concrete surfaces requiring later bond or adhesion. They shall not impede the wetting of surfaces to be cured with water or curing compounds. Surplus oil on forms and form oil on reinforcing steel and construction joints shall be removed before concrete is placed.

03100.2.4 FILLETS FOR CHAMFERED CORNERS

Shall be wood strips 3/4 inch by 3/4-inch size and of maximum possible length.

03100.2.5 MORTAR AND GROUT

Shall be furnished in accordance with Section 03600 herein.

03100.2.6 LIQUID CHEMICAL HARDENER

Shall be a colorless aqueous solution, containing a blend of magnesium fluosilicate, zinc fluosilicate and a wetting agent. The mixture shall contain not less than 2 pounds fluosilicate per gallon and shall not interfere with adhesives and the bonding of finishes where such is indicated.

03100.2.7 WATER

Water for curing shall meet the requirements of Section 03050 herein.

03100.2.8 MOISTURE RETAINING SHEETING

Shall be white, waterproof paper, polyethylene film or burlap-polyethylene sheet which meets the requirements of ASTM C-171.

03100.2.9 MOISTURE ABSORPTIVE COVER MAT

Shall be clean cotton or burlap fabric roll goods.

03100.2.10 CURING COMPOUND

Shall be a clear type with fugitive dye conforming to ASTM C-309, Type 1, unless otherwise approved by the ENGINEER. **CAUTION!!** The method of application of curing compound specified herein requires more product than is normally suggested by the manufacturer and that is customary in the trade. The amounts specified herein shall be applied, regardless of manufacturer's recommendation or customary practice.

03100.3 CONSTRUCTION REQUIREMENTS**03100.3.1 SITE CONDITIONS**

The CONTRACTOR shall examine the condition of the area on which forms are to be installed and conditions under which the work of this Section is to be performed, and shall correct

unsatisfactory conditions which would prevent proper and timely completion of the work. Do not proceed until unsatisfactory conditions have been corrected.

03100.3.2 DESIGN OF FORM-WORK

03100.3.2.1 **LOADING** - Form-work shall be designed to safely support all vertical and lateral loads that may be induced by wet concrete both during the placement and afterward, until such loads can be supported by the structure itself as the concrete sets and begins to cure. Forms and falsework shall be designed to include assumed values of live load, dead load, weight of moving equipment to be operated on form-work, concrete mix, height of concrete drop, vibrator frequency, ambient temperatures, foundation pressures, stresses, lateral stability and other factors pertinent to the safety of the structure during construction.

In form-work design, provide for all openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorage, inserts and other features as required on the Drawings.

03100.3.2.2 **TOLERANCES** – Form-work design shall call out material and components of sufficient strength, thickness, number of ties, amount of bracing, etc., to withstand the pressure of newly placed concrete without bow or deflection.

03100.3.3 FORM-WORK CONSTRUCTION

03100.3.3.1 **COMPLIANCE** – Form-work shall be constructed in compliance with ACI 347, to the exact sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grade, and level and plumb work in finished structures.

03100.3.3.2 **MATERIALS** – Form-work shall be constructed from steel, steel reinforced panels, smooth grade plywood, or other materials which may be approved by the ENGINEER or shown on the Contract Documents for special purposes. Plywood material with raised grain, patches, or other defects that will mar the finished surface of the concrete surface shall not be used.

03100.3.3.3 **ERECTION** - Form facing materials shall be erected, supported, braced and maintained by structural members spaced to prevent deflection. Form-work shall be tight, to prevent leakage of cement paste during concrete placement. Joints shall be solidly butted together and backed up as required to prevent leakage and fins. Forms placed in successive units for continuous surfaces shall be fitted to provide accurate alignment, free from irregularities, and within allowable tolerances. Use selected materials to obtain required finishes.

Provide for all openings, offsets, keyways, recesses, moldings, reglets, chamfers, blocking, screed, bulkheads, anchorage, inserts and other features required. Accurately place and securely support items to be built into forms. Provide formed openings for elements to be embedded in or pass through the concrete. Install accessories in accordance with manufacturer's instructions and ensure items are not disturbed during concrete placement. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support types of screeds required.

Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Bevel wood inserts for forming keyways, reglets, recesses and the like, to prevent swelling and assure ease of removal

Form-work shall accommodate the work of all other trades where materials and products must be purchased and fabricated before the opportunity exists to verify the measurements of the adjacent

construction affecting their installations. Verify size and location of all openings, recesses and chases with the trade requiring such items, and ensure that forms for openings and construction which accommodate installation by other trades, be accurately sized and located as dimensioned on the Drawings.

03100.3.3.4 FORM RELEASE AGENT - Coat form/concrete contact surfaces with form coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.

03100.3.3.5 CLEANING - Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt and other debris just before concrete is placed.

03100.3.3.6 TOLERANCES – The ENGINEER recognizes that, given the realities of the physical world, there are times when formwork for concrete cannot be constructed closely enough to yield zero tolerances in the finished work. Therefore, the following tolerances are allowed but shall not be exceeded:

- In general, deviation in alignment of slabs and walls shall not exceed ¼ inch in the horizontal or vertical dimensions of a pour. All slabs which are indicated to be level shall have a maximum deviation of 1/8 inch in 10 feet without any apparent change in grade.
- The maximum tolerance from true level and plumb throughout the entire length and/or height of a structure shall be +/- ¼ inch and without any abrupt changes from one part of the pour to another.
- Form-work construction for circular structures shall be allowed a maximum deviation in the arc of ¼ inch in each 10 feet of radius; therefor, as an example, a tank with a 50 foot radius shall be allowed a maximum deviation of 1-1/4 inch from the center of the tank to the arc of the wall. In circular construction, the CONTRACTOR also is allowed to deviate from the finish line shown on the Drawings through the use of form panels, which will give chord lengths not to exceed 2 feet.

In the event that deviation from the Drawing dimensions results in problems in the field, the CONTRACTOR shall be responsible for resolution of the conditions, as approved by the ENGINEER, without additional expense to the OWNER.

03100.3.4 REMOVAL OF FORMS

03100.3.4.1 CONSIDERATIONS ASSOCIATED WITH FORM REMOVAL - Forms shall be removed in a manner to insure complete safety of the structure. Forms shall not be removed until concrete has sufficient strength to carry its own weight and the loads upon it with safety. Do not pry against face of concrete; use only wooden wedges.

03100.3.4.2 MINIMUM ELAPSED TIME - Forms shall not be removed sooner than the minimum elapsed times given in the following schedule unless allowed otherwise in the Contract Documents or as directed by the ENGINEER.

When directed by the ENGINEER, because of weather conditions or for other reasons, the forms shall remain in place for longer periods than stated below. The periods of time for form removal set forth below are minimums with no allowances for external loading. The periods of time set forth below are permissive only and do not relieve the CONTRACTOR from responsibility for risks associated with form removal.

MINIMUM ELAPSED TIME

Structural Component	Over 50°F	Between 40° and 50°F
Walls and perimeter forms at slab on grade panels	2 days	3 days
Underside of slabs	10 days	14 days
Side forms of beams	2 days	3 days
Underside of beams	10 days	14 days
Stairways	10 days	14 days

The time periods shown above are based on concrete materials being mixed and placed in accordance with these Specifications. When high early strength inducing admixtures are used in concrete, the ENGINEER may permit form removal after shorter times than those shown in the table. Form removal time also may be reduced if test cylinders of concrete, field cured along with the concrete they represent, have reached the strength specified in Paragraph 03050.3.1 of Section 03050 – Portland Cement Concrete.

03100.3.4.3 RE-SHORING - Where no re-shoring is planned, leave forms and shoring used to support weight of concrete in beams, slabs and other concrete members in place until concrete has attained its specified strength. Where re-shoring is planned, supporting form-work may be removed when concrete has reached 70 percent of specified strength, provided re-shoring is installed immediately.

Place re-shores as soon as practical after stripping operations are complete, but in no case later than the end of the working day on which stripping occurs. During re-shoring, do not subject concrete in beam, slab, column or any other structural member to combined dead, construction, and live loads in excess of loads permitted for developed concrete strength at time of re-shoring. Tighten re-shores to carry required loads without over stressing.

Re-shores shall remain in place until the supported concrete has reached its specified strength.

03100.3.5 CONCRETE FINISHING

03100.3.5.1 FINISHING FORMED SURFACES - Within 72 hours after forms are removed, the CONTRACTOR shall finish exposed surfaces in accordance with one of the procedures described below. Where no finish requirement is provided on the Drawings, formed concrete surfaces exposed to view and surfaces designated to receive paint shall be given a "Smooth" finish and slabs shall be given a "Trowel" finish. When workmanship is less than the acceptable standard, provide one of the rubbed finishes at no additional cost to OWNER.

- F1 - As Cast Form Finish - No finish.
- F2 - Rough Finish - Patch defects and chip or rub off fins exceeding 0.33 inch height.
- F3 - Smooth Finish - In addition to the rough finish requirements, patch tie holes and defects and remove fins completely. When surface texture is impaired and form joints misaligned, grind, bush-hammer or correct such areas. Slurry grout areas evidencing minor mortar leakage to match adjacent concrete. Repair major mortar leakage as a defective area.
- F4 - Smooth Rubbed Finish - Remove forms and perform necessary patching as soon after placement as possible. Finish newly hardened concrete no later than 24 hours following form

removal. Perform a smooth finish, then wet surfaces and rub with carborundum brick or other abrasive until uniform color and texture are produced.

- F5 - Grout Cleaned Rubbed Finish - Undertake this operation after all contiguous surfaces are completed and accessible. Perform a smooth finish, then brush blast with abrasive basting to open surface pores. Wet surface of concrete sufficiently to prevent absorption of water from grout. Mix grout in accordance with Section 03600 and rub a uniform coat over surface to be finished. Immediately after grouting, scrub surface with cork float or stone to coat surface and fill voids. While grout is still plastic, remove excess grout by working surface with rubber float or sack. After surface whitens from drying, rub vigorously with clean burlap. Keep damp for at least 36 hours after final rubbing.
- F6 - Cork Floated Rubbed Finish - Remove forms within 2 to 3 days of placement where possible. Perform a smooth finish and then dampen wall surface. Mix mortar in accordance with Section 03600, and apply with firm rubber float or with trowel, filling all surface voids and compress mortar into voids. If mortar surface dries too rapidly to permit proper compaction and finishing, apply a small amount of water with fog sprayer. Produce a final texture with a cork float using a swirling motion.
- F7 - Unformed Finish - After concrete is placed, strike smooth, tops of walls or buttresses, horizontal offsets and similar unformed surface occurring adjacent to formed surfaces. Float to texture which is reasonably consistent with formed surface. Continue final treatment on formed surfaces uniformly across unformed surfaces.
- F8 - Blasted Finish - Complete a smooth finish then perform abrasive blasting within 24 to 72 hours after casting. Coordinate with form-work construction, concrete placement schedule and form-work removal to ensure that surfaces are blasted at the same age for uniform results. Reapply curing protection after blast finishing.
- F9 - Architectural Finish - Finish in accordance with ACI 303.
- F10 - Tooled Finish - Dress thoroughly cured concrete surface with electric, air or hand tools to uniform texture, and give a bush hammered surface texture. Remove sufficient mortar to exposed coarse aggregate in relief and to fracture coarse aggregate for tooled finish.

03100.3.5.2 REPAIRING FORMED CONCRETE SURFACES - When the Drawings indicate repairs are required or when the ENGINEER determines areas are defective and require repair, the following procedure shall be taken to make repairs:

- Remove defective concrete to sound concrete and make edges perpendicular to surface or slightly undercut. Feathered edges are not permitted.
- Dampen area to be patched and at least 6 inches surrounding it.
- Prepare bonding grout by mixing to consistency of thick cream and brush into surface.
- Tie holes shall be cleaned, thoroughly dampened, and filled solid with patching mortar.
- Make any patches in concrete to closely match color and texture of surrounding surfaces. Determine mix formula for patching mortar by trial to obtain a good color match with concrete when both patch and concrete are cured and dry.
- Mix white and gray Portland cement as required to match surrounding concrete to produce grout having consistency of thick paint. Use a minimum amount of mixing water.

- Mix patching mortar in advance and allow to stand, without addition of water, and without frequent manipulation, until it has reached a stiff consistency. After surface water has evaporated from patch area, brush bond coat into surface. When bond coat begins to lose water sheen, apply patching mortar. Thoroughly consolidate mortar into place and strike-off to leave patch slightly higher than surrounding surface. Leave undisturbed for at least 1 hour before final finish. Keep patched area damp for 72 hours or apply curing compound.
- Do not use metal tools in finishing an exposed patch.
- Where as cast finishes are indicated, total patched area may not exceed 1 in 500 of as cast surface. This is in addition to form tie patches, if ties are permitted to fall within as cast areas.
- In any finishing process which is intended to expose aggregate on surface, patched areas must show aggregate. Outer 1-inch of patch shall contain same aggregates as surrounding concrete. After curing, expose aggregates together with aggregates of adjoining surfaces by same process.

03100.3.5.3 FINISHING SLAB SURFACES - In no case shall water be added to the surface (i.e., by sprinkling) to finish. Slab surfaces shall receive one of the following finish treatments as indicated on the Drawings:

- S1 - Floated Finish - After concrete has been placed, consolidated, struck-off and leveled, do not work further until ready for floating. Begin floating when water sheen has disappeared and surface has stiffness sufficient to permit operation. During or after first floating, check plainness of entire surface with a 10 foot long straightedge applied at 2 or more different angles. Cut down high spots and fill low spots to the required tolerance. Re-float slab immediately to a uniform sandy texture.
- S2 - Trowel Finish - Float finish the surface. Power trowel or hand trowel as required to provide a uniform surface. Do not apply (i.e. sprinkle) water or dry cement to surface of concrete when finishing. First troweling after floating shall produce smooth surface relatively free of defects, but may still show some trowel marks. Second trowel by hand after surface has hardened. Leave finished surface essentially free of trowel marks, uniform in texture and appearance. On surfaces intended to support floor coverings, grind off defects which would show through floor coverings.
- S3 - Broom Finish – Trowel finish the surface. Power trowel or hand trowel as required to provide uniform surface. Lightly brush surface parallel to direction of drainage with a hair broom. Coarseness of broom bristle may be varied slightly, to achieve desired degree of surface roughness.
- S4 - Exposed Aggregate Finish - Immediately after surface of concrete has been leveled to tolerance and surface water has dissipated, spread aggregate uniformly over surface to provide complete coverage to the depth of a single stone. Embed aggregate into surface by light tamping. Float surface until embedded aggregate is fully coated with mortar and surface has been brought to tolerance. Start exposure of aggregate after matrix has hardened sufficiently to prevent dislodgement. Flow ample quantities of water, without force, over surface of concrete while matrix encasing aggregate is removed by brushing with a fine bristle brush. Continue until aggregate is uniformly exposed. An approved chemical retarder sprayed onto freshly floated surface may be used to extend working time.

- S5 - Chemical Hardener Finish - Apply liquid chemical hardener finish to interior concrete floors where indicated. Do not apply liquid chemical concrete hardener on floor areas scheduled to receive synthetic matrice terrazzo, setting beds for tile, terrazzo, vinyl flooring or like items. Apply hardener after complete curing and drying of concrete surface in accordance with manufacturer's recommendations. Evenly apply each coat and allow 24 hours for drying between coats. After final coat of chemical-hardener solution is applied and dried, remove surplus hardener by scrubbing and mopping with water.

03100.3.6 CONCRETE CURING

03100.3.6.1 SURFACES WITH UNREMOVED FORMS - When forms are left in place (i.e., underside of beams, etc.) the CONTRACTOR shall proceed with curing adjacent surfaces without regard to the formed surfaces. When such forms are removed, curing shall then proceed over the entire surface.

03100.3.6.2 CURING CONDITIONS - Immediately after finishing of concrete surfaces (formed or slab) the CONTRACTOR shall verify concrete surfaces are ready for curing. The CONTRACTOR shall correct any conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected. A minimum ambient temperature of not less than 40° shall be maintained for at least 7 days during concrete curing. Concrete shall then be cured by one of the following methods:

- Moisture Cover - Water or continuous water-fog spray shall be applied, or the concrete surface shall be covered with water saturated absorptive mat kept continuously soaked, for not less than 7 days and nights.
- Moisture Retaining Sheet - Place cover in widest practicable width with sides and ends lapped and sealed to prevent moisture loss for a period of not less than 7 days and nights. All holes or tears in the cover sheet shall be kept repaired during the curing period.
- Membrane Curing Compound – All required repairs, patching, and final finishing operations shall be completed prior to application. Curing compound shall be applied as soon as the concrete is firm enough to work on. Slab surfaces shall be coated with curing compound within one hour after form removal; if more than one hour has elapsed, the surface shall be water cured.

The compound shall be thoroughly mixed and a minimum of two coats shall be applied, with each coat applied in a direction different from that used for the preceding coat. The surface shall be coated and re-coated in a continuous operation until the surface has a uniform appearance; is effectively and completely sealed; and until a coating film remains on the surface of the concrete that can be scraped from the surface at any and all points after drying for at least 24 hours. Continuity of the coating shall be maintained, and all damage to the curing compound membrane shall be repaired, during the specified cure period.

Curing compound shall not be allowed within the silhouette of any construction joint. If any curing compound enters the construction joint, the joint shall be sandblasted prior to placing any new concrete.

Curing compound shall not be used on surfaces to be painted or coated.

Surfaces intended to contain potable water (tank interiors, etc.) shall not be cured with curing compounds.

Curing compound shall not be removed in less than 7 days from the time of application without written approval from the ENGINEER. When approved and prior to such removal, the CONTRACTOR shall provide a detailed plan for adequately curing the concrete.

03100.4 METHOD OF MEASUREMENT

Unless otherwise noted in the Special Provisions, separate measurement will not be made for concrete included as components of items shown in the Bid Schedule. Separate measurement for formed concrete and slabs shall be in accordance with the requirements of Section 03300.

03100.5 BASIS OF PAYMENT

Unless otherwise noted in the Special Provisions, no separate payment will be made for concrete included as components of items shown in the Bid Schedule. Separate payment for formed concrete and slabs shall be in accordance with the requirements of Section 03300.

03200.1 DESCRIPTION

Includes steel bars, wire fabric and rod mats required for cast-in-place concrete, with the necessary support chairs, bolsters, bar support and spacers required for supporting the reinforcement.

03200.1.1 RELATED Work

Section 03050 - Portland Cement Concrete
Section 03300 - Concrete Structures and Slabwork
Section 04810 - Unit Masonry Assemblies

03200.1.2 SUBMITTALS

03200.1.2.1 MILL TEST CERTIFICATION - Manufacturer's mill test certificates of supplied concrete reinforcement, indicating physical and chemical analysis shall be submitted.

03200.1.2.2 WELDER CERTIFICATION - Each welder's certification data shall be submitted to and approved by the ENGINEER prior to performance of welding on the project.

03200.1.2.3 SHOP DRAWINGS - Shop Drawings shall be submitted and shall indicate the sizes, spacings, locations and quantities of reinforcing steel and wire fabric; bending and cutting schedules; any proposed splicing; and reinforcement support, spacing devices and stirrup spacing.

03200.1.2.4 BAR SUPPORT SAMPLES - The CONTRACTOR shall submit for the ENGINEER's approval, samples of all bar supports it proposes to use along with a written description of where each type of bar support would be used.

03200.1.3 DEFINITIONS

Not used.

03200.2 MATERIALS**03200.2.1 CONCRETE REINFORCEMENT MATERIALS**

03200.2.1.1 STEEL REINFORCEMENT - Unless otherwise specified, reinforcing steel shall be grade 60 billet steel conforming with ASTM A-615, including supplementary requirements S1. All such reinforcing shall be deformed steel bars with deformations in accordance with ASTM A-615. Bars shall be either uncoated or coated as indicated. ASTM A-706 steel shall be used if welding is indicated or allowed. All reinforcement shall be supplied in the maximum lengths practical or as indicated, unless otherwise authorized by the ENGINEER.

03200.2.1.2 WIRE FABRIC - Welded steel wire fabric shall be in accordance with ASTM A-185 plain type. It shall be new stock and free of any rust when placed in the Work. Wire fabric may be supplied in flat sheets or coiled rolls, and may be either coated or uncoated as indicated.

03200.2.1.3 STIRRUPS - Stirrup steel shall be in accordance with ASTM A-82.

03200.2.1.4 SPIRAL REINFORCEMENT - Spiral reinforcement for columns or other components shall be cold drawn steel wire in accordance with ASTM A-82.

03200.2.1.5 DOWEL BARS - Plain dowel bars for expansion joints shall be in accordance with ASTM A-615, 60-ksi-yield grade steel. Dowel bars shall be epoxy coated in roadway pavements. Metal dowel

cans shall be provided at one end of dowel to permit longitudinal movement of the dowel within the concrete section. The CONTRACTOR shall provide for movement equal to the joint width plus 0.5-inch. Load transfer bars shall be painted with 1 coat of paint conforming to AASHTO M-254 and coated 1/2 with grease.

03200.2.2 ACCESSORY MATERIALS

03200.2.2.1 TIE WIRE - Tie wire shall be 16-gauge minimum cold drawn plain steel wire, and shall be in accordance with ASTM A-82.

03200.2.2.2 REINFORCEMENT SUPPORTS - Unless otherwise required in the Drawings or these Specifications, reinforcement supports bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place shall be wire type bar supports complying with CRSI recommendations. Wood, brick, and other unacceptable materials will not be allowed.

03200.2.2.3 SUPPORTS EXPOSED TO VIEW - Where support legs are in contact with forms on concrete surfaces exposed to view, supports shall be stainless steel or shall be provided with either hot-dip galvanized or plastic protected legs.

03200.2.3 FABRICATION

03200.2.3.1 STANDARDS - Steel reinforcement shall be cut, bent and fabricated in accordance with ACI 315 and with approved machine methods, in either the shop or the field.

03200.2.3.2 BENDING - Bars shall be accurately formed to the dimensions shown on the Drawings or applicable bending schedule. Bending or straightening in the shop or the field shall be accomplished so that the steel is not damaged. All bars shall be cold bent. Bends for hooks on bars shall be made around a pin having a diameter not less than 6 times the minimum thickness of the bar. Kinked bars shall not be used. Bars with bends not indicated on Drawings or final Shop Drawings shall not be placed in the Work. Reinforcement bars shall not be bent after they are embedded in concrete.

03200.2.3.3 SPLICES - Reinforcing splices not indicated on the Drawings shall be approved by the ENGINEER, and shall be located at points of minimum stress. The location of splices shall be indicated on Shop Drawings. Welding of reinforcing bars, when authorized by the ENGINEER, shall be performed in accordance with AWS D1.4. All rebar which is welded shall be grade 60 ASTM A706 material.

03200.3 CONSTRUCTION REQUIREMENTS**03200.3.1 DELIVERY AND STORAGE**

03200.3.1.1 DELIVERY - Deliver reinforcement to the job site bundled, tagged and marked. Use metal tags indicating bar size, lengths and other information corresponding to markings shown on placement diagrams.

03200.3.1.2 STORAGE - Take all means necessary to protect reinforcement materials before, during and after installation and to protect the installed work of other trades. Store all reinforcement materials in a manner to prevent excessive rusting and fouling with grease, dirt and other bond breaking coatings. Take all necessary precautions to maintain identification after bundles are broken. In the event of damage or errors, immediately make all repairs or replacements necessary and at no additional cost to the OWNER.

03200.3.2 REINFORCEMENT ERECTION

03200.3.2.1 CLEAN AND SOUND MATERIALS - At the time of placement in the Work, reinforcement shall be free of loose mill scale, loose or excessive rust, paint, oil or grease, or other coating which may destroy its bond with the concrete. Bars with reduced cross-section due to rusting or other cause, even if all rust has been removed, shall not be allowed in the Work.

03200.3.2.2 CLEARANCE - Maintain the distance from vertical forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers or other approved devices in accordance with "reinforcement support" paragraphs below. Placement and fastening of reinforcement in each section of the Work must be approved before concrete is placed.

03200.3.2.3 CLEAR DISTANCE - The clear distance between parallel bars shall not be less than one and one-half times the diameter of the bars, and shall in no case be less than 1 inch nor less than the maximum size of the coarse aggregate specified.

03200.3.2.4 MINIMUM COVER - Unless otherwise shown on the Drawings or approved by the ENGINEER, for all formed surfaces, the minimum concrete cover over the steel reinforcement shall be 1 1/2 inches for bars number 5 and smaller and 2 inches for bars number 6 through 18. The largest specified cover shall be used when different sized bars are encountered in the same face. No "bury" or "carrier" bars will be allowed unless specifically approved by the ENGINEER.

03200.3.2.5 CUTOUTS AND OPENINGS - Where reinforcing steel has to be cut to permit passage of pipe or to create openings with no detail available on the Drawings for extra reinforcement in such areas, the area of steel removed by the creation of the opening must be replaced by placement of at least double the area of the steel removed equally around the openings created. The steel shall be placed such that it extends 5 feet beyond the opening on each side, to provide for sufficient bond.

03200.3.2.6 METAL MESH - Sheets of metal mesh shall be bent as shown or required on the Drawings to fit the work. It shall be rolled or otherwise straightened to make a perfectly flat sheet before placement in the Work. Supports for metal mesh shall meet requirements for reinforcing bar supports.

Sheets of metal mesh shall be spliced in accordance with ACI 318 and shall be overlapped no less than 12 inches or one square plus 6 inches, whichever is greater, to maintain a uniform strength. The mesh shall be securely fastened at the ends, edges and at all supports to maintain clearances and overlaps.

03200.3.2.7 NOTICE TO OTHER TRADES - The CONTRACTOR shall ensure that all other crafts, sub-contractors, engineering support groups, and etc., whose work is related to concrete placement, are provided with ample notice and opportunity to introduce and finish required embedded items before concrete placement. All sleeves, inserts, anchors and any other embedded items shall be located and set in place prior to concrete placement. All voids in embedded items shall be temporarily filled to prevent entry of concrete.

03200.3.3 SPLICING

03200.3.3.1 ENGINEER APPROVAL - Except as shown on the Drawings, reinforcing steel shall not be spliced at any location without specific written approval of the ENGINEER. Splices in adjacent bars shall be staggered as directed by the ENGINEER.

03200.3.3.2 LAP SPLICES - Unless shown otherwise on the Drawings, or approved by the ENGINEER, bars up to and including number 11 shall be lap spliced in accordance with ACI 318 and shall be fastened together with steel wire.

Unless shown otherwise on the Drawings, or approved by the ENGINEER, bars at a lap splice shall be in contact with each other, and in no case shall the lap be less than 40 diameters of the spliced bars.

Unless shown otherwise on the Drawings, or approved by the ENGINEER, where bars are to be lap spliced at joints in the concrete, all bars shall project from the concrete first placed for a minimum length equal to the lap splice length as indicated on the Drawings. All concrete or other deleterious coating shall be removed from dowels and other projecting bars by wire brushing or sand blasting before the bars are embedded in a subsequent concrete placement.

03200.3.3.3 WELDING - Reinforcing steel shall be welded only if shown on the Drawings, or approved in writing by the ENGINEER. All welding of reinforcing steel shall comply with AWS D1.4.

03200.3.3.4 EXPANSION JOINTS - Reinforcement, or other embedded metal items bonded to the concrete, shall not be permitted to extend continuously through any expansion joint, with the exception of dowels in floors bonded on only one side of joint.

03200.3.4 REINFORCEMENT SUPPORT

03200.3.4.1 PLACEMENT - All reinforcement shall be supported and retained in place, true to indicated lines and grades, by the use of approved bar supports, sized to position the steel in the exact location required on the Drawings. Supports shall be spaced at intervals of not more than 5 feet on center in any direction, to prevent movement of the steel during concrete placement. Deck steel shall be tied down to beams or forms at regular intervals not exceeding 5 feet on center in any direction.

03200.3.4.2 CONCEALMENT - Supports shall be completely concealed in the concrete and shall not discolor or otherwise mar the surface of the concrete.

03200.3.4.3 SAND PLATES - Supports with sand plates or horizontal runners shall be used for slabs on grade where the base material will not support chair legs.

03200.3.5 QUALITY COMPLIANCE

Reinforcing materials found to be damaged or at variance with the requirements of the Drawings or these Specifications for size, quantity, strength, position, arrangement, or other attribute, shall result in rejection of the concrete Work if they are not brought into compliance.

03200.4 METHOD OF MEASUREMENT

03200.4.1 NO MEASUREMENT

Unless shown otherwise, concrete reinforcement shall be included with the concrete item within which it is installed and no separate measurement shall be made.

03200.4.2 SEPARATE MEASUREMENT

When shown as a separate item on the Bid Schedule, measurement of reinforcing steel will be, based on the theoretical or calculated number of pounds placed and accepted according to the requirements of the Drawings and these Specifications. Measurement shall exclude splice bars used to replace test samples. No deductions will be made for any bends except for hooks. The length of the bar to be added to out-to-out dimensions of hooked bars will be shown on the plans. The weight calculations shall be based upon the following table:

WEIGHT CALCULATIONS FOR REINFORCING STEEL

Size	Lbs. per Lineal Foot	Size	Lbs. Per Lineal Foot
1/3 inch	0.167	#8	2.670
#3	0.376	#9	3.400
#4	0.668	#10	4.303
#5	1.043	#11	5.313
#6	1.502	#14	7.650
#7	2.044	#18	13.600

03200.5**BASIS OF PAYMENT**

The accepted quantities of reinforcing steel will be paid for at the contract unit price. No allowance will be made for clips, wires or other material used for fastening reinforcement in place.

Payment will be made under:

PAY ITEM	UNIT
Reinforcing Steel	Pound

03300.1 DESCRIPTION

Covers concrete placement operations for cast-in-place structural building frames, slabs and other components.

03300.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing and Curing
Section 03200 - Concrete Reinforcement
Section 03310 - Concrete Joints for Slabwork
Section 03600 - Grout and Mortar

03300.1.2 SUBMITTALS

03300.1.2.1 RECORD OF PLACED CONCRETE - CONTRACTOR's record of placed concrete, which indicate the date, time, temperature, location, quantity, names/types of any additives used, and type of curing materials or procedures used.

03300.1.2.2 DELIVERY TICKETS - Copies of delivery tickets which indicate the date and time of delivery; the producer and the truck number; the volume of delivery; and the amounts (weights) of cement, aggregates and any additives, including all water added at plant and in the field.

03300.1.3 DEFINITIONS

Not used.

03300.2 MATERIALS**03300.2.1 CONCRETE**

Shall meet Class and material requirements of Section 03050.

03300.2.2 BONDING COMPOUND

Shall be polyvinyl acetate or acrylic base, non-rewettable type.

03300.2.3 VAPOR BARRIER

Shall be minimum 6 mil thick, polyethylene sheet, and the CONTRACTOR shall allow for 6 inch overlap at all edges, unless shown otherwise on Drawings. Vapor Barrier required for below grade application shall be free from pin holes, tears, scars and other defects.

03300.2.4 FORMS

Shall meet requirements of Section 03100.

03300.2.5 REINFORCEMENT

Shall meet requirements of Section 03200.

03300.2.6 COVERINGS AND CURING COMPOUND

Shall meet requirements of Section 03100.

03300.2.7 GROUT

Shall meet requirements of Section 03600.

03300.2.8 WATERSTOP

Waterstop shall be of the materials described and placed in the joints where shown on the Drawings and called for in these specifications. Precautions to insure proper support and location for the waterstop during concrete placement shall be taken.

03300.3 CONSTRUCTION REQUIREMENTS**03300.3.1 PREPARATION**

03300.3.1.1 ENGINEER NOTIFICATION - The ENGINEER shall be given not less than 24 hours notice of a pour before it starts.

03300.3.1.2 REINFORCEMENT AND OTHER MATERIALS - All anchors, seats, plates, reinforcement and other items, to be embedded or cast into concrete, shall be accurately placed, held securely, and not impede concrete placement.

03300.3.1.3 CONSTRUCTION LOADS - The CONTRACTOR shall ensure that construction loads shall not exceed member capacity.

03300.3.1.4 PREVIOUSLY PLACED CONCRETE - The CONTRACTOR shall prepare previously placed concrete by bush hammering or cleaning with steel brush, as required by the Drawings or these Specifications, and by application of the required bonding compound in accordance with manufacturer's instructions.

03300.3.1.5 DOWELING TO EXISTING WORK - At locations where new work is to be doweled to existing work, the CONTRACTOR shall drill 1 inch minimum oversize holes 20 bar diameters deep into the existing concrete. Holes shall be thoroughly cleaned with oil free air filled with epoxy grout from the bottom out, then insert the dowel full depth.

03300.3.1.6 TEMPERATURES - Temperature at the time of placement shall meet requirements provided in Section 03050 and Subsection 03300.3.4.1 below.

03300.3.1.7 DELIVERY - The CONTRACTOR shall ensure that concrete delivery meets all requirements of Section 03050.

03300.3.2 CONCRETE PLACEMENT

Concrete shall be conveyed, deposited and consolidated by methods that preclude separation or loss of ingredients.

03300.3.2.1 CONVEYING OF CONCRETE – Conveying of concrete shall be carried out as follows:

- Chutes for conveying concrete shall be sloped to permit concrete of the required consistency to flow without segregation.
- Where necessary, chutes shall be supplied with baffle boards or a reversed section at the outlet.

- Concrete shall not be allowed to drop more than 6 vertical feet without the assistance of pipes or tremies.

03300.3.2.2 DEPOSITION OF CONCRETE – Deposition of concrete shall adhere to the following requirements:

- Concrete shall not be placed if the subgrade is muddy, soft, or frozen.
- Concrete shall be deposited as near to its final position as practical.
- Use of vibrators for shifting concrete is not permitted.
- Concrete shall be placed in horizontal layers insofar as practical with placement starting at the low point and proceeding up grade.
- Concrete slabs or footings shall be placed on compacted soil surfaces and the subgrade shall have a dampened condition. To achieve the dampened condition, the subgrade may be sprinkled with water in advance of placing concrete.
- Concrete placement shall be continuous between construction joints and shall be terminated with square ends and level tops unless otherwise shown on the plans.
- Concrete shall not be placed in horizontal sections until the concrete in the adjoining vertical members has been consolidated and 2 hours has elapsed to allow for shrinkage.
- Where concrete is to be deposited against hardened concrete joints, placement shall not begin until a grout mixture has been coated on the joint. This grout mixture shall consist of mixture prescribed in Section 03600.

03300.3.2.3 CONSOLIDATION OF CONCRETE - Consolidation of concrete, except for slope paving and concrete placed underwater, shall be accomplished through the use of vibrators as follows:

- A sufficient number of spare vibrators shall be kept available to preclude interruption of concrete placement due to vibrator failure and to have the capacity to consolidate the concrete mass within 15 minutes after placement in the forms.
- The location, manner and duration of the application of the vibrators shall be such as to secure maximum consolidation of the concrete without separation of the mortar and coarse aggregate, and without causing water or cement paste to flow to the surface.
- Vibrators shall be operated so as not to contact the subgrade, reinforcing steel or form work, and shall not be used to move the mass of concrete horizontally.
- External vibration, except for vibrating screeds, shall not be used, unless approved by the ENGINEER prior to the start of concrete placement.

03300.3.3 WATERSTOPS

Waterstops in the walls shall be carried into the slabs below and shall join the waterstops in the slabs with factory-made fittings or welded joints. All joints in water-bearing structures shall have waterstops, whether indicated on the plans or not. For other location requirements for waterstops, see the general notes of the plans.

03300.3.4 TIME LIMITATIONS

Mixed concrete shall be rejected if it is not placed within 90 minutes after water is introduced into the mixture and air temperature is 80°F or less, or if it is not placed within 60 minutes after water is introduced into the mixture and air temperature is above 80°F; or if the initial set has developed.

03300.3.5 HOT OR COLD WEATHER PLACEMENT REQUIREMENTS

03300.3.5.1 TEMPERATURE LIMITATIONS - Concrete temperature shall be between 50°F and 90°F at the time of placement in the forms.

03300.3.5.2 HOT WEATHER CONDITIONS - Hot weather conditions shall be considered to exist when ambient temperatures exceed 90⁰ F, or when the ambient temperature is below 90⁰ F but the temperature to humidity relationships shown in the following table for conditions below 90⁰ F exist.

TEMPERATURE/HUMIDITY RELATIONSHIP

Relative Humidity Less Than (Percent)	Air Temperature Greater Than (°F)	Maximum Concrete Temperature (°F)
80	90	90
70	90	90
60	90	90
50	90	85
40	90	80
30	80	75
20	75	70

During hot weather conditions, the CONTRACTOR shall take the following steps to protect the concrete:

- The concrete ingredients shall be cooled before mixing to maintain concrete temperature at time of placement below the maximum acceptable values listed in the table below.

Mixing water may be chilled, or chopped ice may be used to control the concrete temperature, provided the water equivalent of the ice is calculated into the total amount of mixing water. Ice shall be completely melted and dispersed throughout the mix at the completion of the mixing time.

All methods and equipment for cooling of water and aggregate shall be subject to approval of the ENGINEER, and shall conform to ACI 305.

- Reinforcing steel shall be covered with water-soaked burlap as required, to prevent the steel temperature from exceeding the ambient air temperature immediately before concrete placement.
- Forms shall be thoroughly wet, but free of standing water, before concrete placement. Concrete should be placed in shallower layers than under normal weather conditions if necessary to assure coverage of the previous layer while it will respond readily to vibration.

- Fog spray shall be used during finishing whenever necessary to avoid surface plastic-shrinkage cracking. Fog spray shall also be used after finishing, before the specified curing is commenced, to avoid surface plastic-shrinkage cracking.
- Forms shall be kept covered and continuously moist. Once forms are loosened and during form removal, concrete surfaces shall be protected from drying, and shall be kept continuously wet by fog spraying or other approved means.

Additional costs due to concrete placement in hot weather conditions shall be the responsibility of the CONTRACTOR.

03300.3.5.3 COLD WEATHER CONDITIONS - Cold weather limitations shall apply when air temperature falls below 40°F. Procedures for protecting concrete shall be in accordance with ACI Standard 306, "Recommended Practice for Cold Weather Concreting." If concrete placement is necessary during low temperature conditions, the CONTRACTOR shall take the following steps to protect the concrete:

- The CONTRACTOR shall heat all water and aggregates uniformly in accordance with Section 03050 before mixing, to obtain a concrete mixture temperature between 60°F and 90°F at the time of placement.
- The CONTRACTOR shall not use calcium chloride, salt or other material containing antifreeze agents or chemical accelerators unless approved otherwise in writing by the ENGINEER.
- If temperatures are expected to drop below 32°F the night before the concrete is placed, all reinforcement, the forms, and the ground shall be blanketed. If the temperature falls below 20°F, the area shall be preheated at a minimum temperature of 40°F for a minimum of 12 hours prior to placement.
- The concrete shall be protected from freezing. The CONTRACTOR shall furnish all materials and equipment to insulate and to heat the work as necessary to maintain concrete temperatures above 50°F.
- Concrete temperature shall be maintained at not less than 50°F and not more than 70°F for the first 7 days after placement.
- Combustion type heaters, which produce carbon monoxide (CO), shall be adequately vented.

The CONTRACTOR shall assume all risk in connection with placing concrete in cold weather conditions. Permission given to place concrete in cold weather shall in no way relieve the CONTRACTOR of the responsibility for compliance with these Specifications. Any work not in compliance with these Specifications due to cold weather conditions shall be removed and replaced at the CONTRACTOR's expense.

03300.3.6 JOINTS

03300.3.6.1 COMPLIANCE - Construction joints shall be placed at the locations shown on the Drawings or as approved by the ENGINEER. Expansion and contraction joints and joint sealing shall be accomplished in accordance with Section 03310.

03300.3.6.2 CLEANING - Unless otherwise directed by the ENGINEER, all construction joints shall be cleaned prior to placement of concrete. All unsatisfactory concrete, latency material, stains,

debris, and other foreign materials shall be removed. After cleaning, the surface shall be washed thoroughly to remove all loose material. Excess water shall be disposed of in such manner that it will not stain, discolor, or otherwise affect adjacent surfaces of the structures.

03300.3.7 FINISHING

Finishing shall be accomplished as indicated on the Drawings and in accordance with the requirements of Section 03100. Water shall not be sprinkled on concrete surfaces during finishing.

03300.3.8 CURING

Curing shall meet the requirements of Section 03100.

03300.3.9 PROTECTION

The CONTRACTOR shall provide necessary barriers, walkways, etc. to protect freshly placed concrete from physical damage. Any damage sustained as a result of failure to provide such protection shall be corrected at the CONTRACTOR's expense.

03300.3.10 REPAIR OF DEFECTIVE CONCRETE

03300.3.10.1 REPAIR FOR NON-COMPLIANCE - All concrete that fails to conform to required material characteristics, dimensions, lines, finishes and elevations shown on the Drawings, or in accordance with these Specifications shall be replaced or corrected in accordance with these Specifications and as approved by the ENGINEER.

03300.3.10.2 ADDITIONAL TESTING - Any engineering analysis and additional testing required to determine the extent of repair will be provided by the CONTRACTOR at no additional cost to the OWNER.

03300.3.10.3 REMOVAL OF SLABS WITH CRACKS - Removal of concrete sections with cracks in slabs which occur within 2 feet of expansion or construction joints may be deemed necessary by the ENGINEER.

03300.3.11 QUALITY COMPLIANCE

Concrete work may be rejected for failure to comply with the following requirements:

03300.3.11.1 SPECIFICATION NON-COMPLIANCE - Concrete work shall be rejected if the materials used in the work fail to comply with the requirements of Section 03050 and 03200.

03300.3.11.2 STRENGTH TEST FAILURE - Concrete work, for which the average of three 28-day compressive or flexural strength samples made from the same batch falls below the acceptance level, shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.3 IMPROPER CURING - Concrete work for which the method of curing is not as specified, or that has been inadequately protected from extremes of temperature during the early stages of hardening and strength development, shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.4 ACCIDENT AND INJURY - Concrete work that has been subjected to construction fires, accidents, mechanical injury or premature removal of formwork likely to result in deficient strength development, shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.5 POOR WORKMANSHIP - Concrete work, subjected to poor workmanship that may result in deficient strength or load carrying capacity, including but not limited to honey combing, cold joints, introduction of contaminants or embedded debris, improper placement location or dimensions, and etc., shall be rejected, unless otherwise directed by the ENGINEER.

03300.3.11.6 POOR FINISH - Concrete work that fails to meet the required finish in accordance with the requirements of Section 03100, or exposed concrete with defects adversely affecting the appearance of the specified finish shall be rejected, unless otherwise directed by the ENGINEER.

03300.4 METHOD OF MEASUREMENT

03300.4.1 NO MEASUREMENT

When concrete is not indicated as a separate item in the Bid Schedule, no measurement will be made and the concrete required for a structure shall be considered a component of another item or items shown in the Bid Schedule.

03300.4.2 SEPARATE MEASUREMENT

03300.4.2.1 CUBIC YARD - When concrete is indicated as a separate item on the Bid Schedule, measurement shall be made by counting the number of cubic yards placed and accepted as determined by calculating volumes using the dimensions shown on the Drawings. This measurement shall NOT include:

- Any allowance for reinforcing steel in concrete.
- Any allowance for concrete required for filling over-excavation for footings, walls or slabs.
- Any allowance for volume occupied by pipes (except culverts), reinforcing steel, anchors, conduits, or weep holes.

03300.4.2.2 SQUARE UNIT – Measurement for square feet or yards of concrete shall be made using an accurate measuring device to determine the length and breadth of concrete placed and accepted and then multiplying those values to find the amount of area covered.

03300.5 BASIS OF PAYMENT

The accepted quantities shall be paid for at the contract unit price:

PAY ITEM	UNIT
Concrete (<i>Class</i> _____)	Cubic Yard
Concrete (<i>Class</i> _____)	Square Yard
Concrete (<i>Class</i> _____)	Square Foot
Concrete Structure (<i>Name</i>)	Lump Sum

03310.1 DESCRIPTION

Furnish materials and install appropriate longitudinal and transverse expansion joints, construction joints and crack control joints in slabs and pavement.

03310.1.1 RELATED WORK

Section 03050 - Portland Cement Concrete
Section 03100 - Concrete Forming, Finishing, and Curing
Section 03300 - Concrete Structures and Slabwork

03310.1.2 SUBMITTALS

The CONTRACTOR shall submit the following to the ENGINEER for review and approval:

03310.1.2.1 PRODUCT CERTIFICATION – The manufacturer's certification that product was manufactured, tested and supplied in accordance with source control requirements specified herein, together with a report of the test results and the date each test was completed.

03310.1.2.2 INSTRUCTIONS – The manufacturer's instructions for joint preparation, type of cleaning and installation.

03310.1.2.3 DATA SHEETS – The manufacturer's product and safety data for each joint sealant product required.

03310.1.2.4 SAMPLES – A manufacturer's sample of each joint sealant product required.

03310.1.3 DEFINITIONS

Not used.

03310.2 MATERIALS**03310.2.1 GENERAL**

03310.2.1.1 COMPATIBILITY OF MATERIALS - Provide joint filler, sealant backings, sealants and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

03310.2.1.2 DELIVERY OF MATERIALS - Deliver materials to site in original unopened containers or bundles with labels identifying manufacturer, product name and designation, color, expiration period for use, pot life, cure time and mixing instructions for multi-component materials.

03310.2.1.3 STORAGE AND HANDLING OF MATERIALS - Store and handle materials in compliance with manufacturer's recommendations to prevent deterioration; or damage due to moisture, high or low temperatures, contaminants or other causes.

03310.2.2 PRODUCTS

03310.2.2.1 JOINT VOID FORMER - Shall be of plastic with a waterstop and shall extend 1/3 of the depth of the concrete structural section.

03310.2.2.2 JOINT FILLER - J4 joint filler shall be the required standard and shall be used unless another filler from the list below is specified. Fillers shall be non-extruding, resilient, and meet the requirements of ASTM D-545:

- F1 Joint Filler – 13mm thick filler for expansion joints; bituminous (asphalt or tar) mastic in accordance with ASTM D-994; formed and encased between 3 layers of bituminous saturated felt or 2 layers of glass fiber felt.
- F2 Joint Filler - Cane or other cellulosic fiber in accordance with ASTM D-1751, saturated with asphalt.
- F3 Joint Filler - Granulated cork in accordance with ASTM D-1751; in an asphalt binder; encased between 2 layers of asphalt saturated felt or 2 layers of glass fiber felt.
- F4 Joint Filler - Sponge rubber fully compressible in accordance with ASTM C-1752, with resiliency recovery rate of 90 percent minimum.
- F5 Joint Filler - Cork in accordance with ASTM C-1752; impregnated and bound with asphalt; compressible with resiliency recovery rate of 90 percent if not compressed more than 50 percent of original thickness.
- F6 Joint Filler - Plastic foam (for cold-applied sealants only) pre-formed, compressible, resilient, non-waxing, non-extruding strips of flexible, non-gassing plastic foam; non-absorbent to water and gas; 20 lb/ft³ density maximum; and of size and shape to control sealant depth and performance.
- Synthetic Sponge Rubber Filler - Synthetic sponge rubber filler shall be an expanded closed cell sponge rubber, manufactured from a synthetic polymer neoprene base. The material shall be No. 750.3 Ropax Rod Stock as manufactured by the Presstite Division of Interchemical Corporation; Bondtex as manufactured by Rubatex Corporation; or approved equal. The size of the material shall be 25 percent greater in diameter than the nominal joint width. The manufacturer's instructions for surface preparation and application shall be used as a guide for installation, except that the material shall not be installed by stretching beyond its normal length.

03310.2.2.3 SEALANT - Hot applied joint sealant shall be one of the following:

- HAS1 Sealant - Resilient and adhesive compound type in accordance with ASTM D-3405, for Portland cement concrete or asphalt concrete pavements.
- HAS2 Sealant - Thermoplastic type in accordance with ASTM D-3581, jet fuel resistant without rubber, unless indicated otherwise.
- HAS3 Sealant - Elastomeric type in accordance with ASTM D-1190.
- HAS4 Sealant - Elastomeric type in accordance with ASTM D-3406, one component, for Portland cement concrete pavements.
- HAS5 Sealant - Elastomeric type in accordance with ASTM D-3569, one component, jet-fuel resistant, for Portland cement concrete pavements.

Cold applied joint sealant shall be one of the following:

- CAS1 Sealant - Elastomeric type in accordance with ASTM C-920; chemically curing, for vehicular or pedestrian use and types of construction other than highway and airfield pavements and bridges and joint substrates indicated; Type S or M; Grade P or NS; Class 25; Use T, NT, M and O with the following characteristics:
 - ⇒ Self leveling
 - ⇒ 40 ± 5 ASTM D-2240 Shore A Hardness
 - ⇒ 4 days minimum final cure
 - ⇒ 10 to $+150^0$ F service range
- CAS2 Sealant - Mastic type in accordance with ASTM D-1850, single or multiple companion, for joints having a minimum width of 1/2 inch.
- CAS3 Sealant - Coal tar modified urethane type in accordance with FS SS-S-200; one part, jet fuel resistant; Type H.
- CAS4 Sealant - Elastomeric, pre-formed polychloroprene type with lubricant adhesive and indicated movement ratio which meets one of the following:
 - ⇒ For concrete pavement seal; ASTM D-2628
 - ⇒ For concrete bridge seal; ASTM D-3542

Synthetic rubber sealant shall be as follows:

- The sealant shall be a 3-part polyurethane compound.
- Sealant shall be designed to cure at room temperature to a firm, highly resilient rubber.
- Sealant shall have the following properties determined at conditions of 75° F and 50 percent relative humidity:
 - ⇒ Base - polyurethane rubber
 - ⇒ Solids - not less than 97 percent
 - ⇒ Application time - not less than 3 hours
 - ⇒ Cure time - not more than 5 days
 - ⇒ Ultimate hardness - 35 ± 5 (Shore A Durometer)
 - ⇒ Tensile strength (ASTM D412) - 300 pounds per square inch minimum
 - ⇒ Ultimate elongation - not less than 300 percent
 - ⇒ Color - gray to match concrete unless otherwise indicated
- All packages shall be code dated. No material shall be more than 6 months old when used. Material shall have been kept at temperatures lower than 80° F at all times.

03310.2.2.4 **BACKER ROD** – Backer rod shall be neoprene, butyl, EPDM, or silicone tubing complying with ASTM D-1056, water and gasoline non-absorbent, capable of remaining resilient at temperatures down to -26°F. Provide product with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

03310.2.2.5 **BOND BREAKER TAPE** – Bond breaker tape shall be self-adhesive polyethylene or other plastic tape as recommended by sealant manufacturer for preventing sealant from adhering to joint filler materials or joint surfaces at back or bottom of joint.

03310.2.2.6 WATERSTOPS - Waterstop shall be rubber waterstop or PVC waterstop as designated on the Plans or in the Special Provisions and shall meet the requirements described herein.

- Waterstops shall be as manufactured by Burke Concrete Accessories Inc., Kirkhill Rubber Company, Williams Products Inc., Greenstreak, or approved equal:
- Waterstop shall be of the width and cross-section configuration shown on the Drawings or required in the Special Provisions.
- At expansion joints, only hollow centerbulb type waterstop shall be used.

Rubber waterstop shall meet the following requirements and conditions:

- Waterstop shall be manufactured to ensure 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" in longest lateral dimension and less than 1/16" deep, will be acceptable.
- The rubber waterstop shall meet the following Specifications:
 - ⇒ Hardness-Shore A Durometer – 60 to 70, ASTM D 2240
 - ⇒ Elongation - not less than 450%
 - ⇒ Tensile Strength - not less than 3,000 psi
 - ⇒ Tensile Strength after aging 48 hours in oxygen at 70°C and 300 psi - not less than 80% of original
 - ⇒ 300% Modulus - not less than 900 psi
 - ⇒ Water absorption after 2 days at 158°F – not more than 5%
 - ⇒ Compression set after 22 hours at 158°F - not more than 30%
 - ⇒ Specific Gravity - 1.17 ± .03

Polyvinylchloride (PVC) waterstop shall be as manufactured by Greenstreak, or approved equal, and shall meet the following requirements and standards:

<u>Property</u>	<u>ASTM Test</u>	<u>Nominal Value</u>
⇒ Water absorption	D 570	0.15
⇒ Tear resistance	D 624	350/lb.in.
⇒ Ultimate elongation	D 638	390%
⇒ Tensile strength	D 638	2250 psi min.
⇒ Low temperature brittleness	D 746	+35 ⁰ F/+37 ⁰ C (passed at)
⇒ Stiffness in flexure	D 747	1190 psi
⇒ Specific gravity	D 792	1.37
⇒ Ozone resistance	D 1149	No failure
⇒ Volatile loss	D 1203	0.30%
⇒ Hardness (Shore A15)	D 2240	76+3
⇒ Accelerated Extraction		
Tensile strength		2130 psi
Elongation		370%

PVC waterstop shall be heat weldable, have great inherent elasticity, be impervious to many waterborne chemicals, be suitable for above or below grade installation, not produce electrolytic reactions, and not discolor concrete or mortar.

See Subsection 03310.3.4 for waterstop installation specifications.

03310.3 CONSTRUCTION REQUIREMENTS**03310.3.1 WEATHER CONDITIONS**

Do not proceed with installation of joint sealant under unfavorable weather conditions. Install elastomeric sealant only when temperature is stable within the temperature range recommended by manufacturer for installation.

03310.3.2 PREPARATION

03310.3.2.1 JOINT CLEANING - Clean, prepare and size joints in accordance with manufacturer's instructions. Remove any loose materials and other foreign matter. Do not proceed with installation of joint sealant until contaminants capable of interfering with sealant adhesive properties are removed from joint substrates. Remove any moisture on the substrate.

Remove protective coating and any oil from metals with solvent recommended by the sealant manufacturer.

03310.3.2.2 JOINT DIMENSIONS - Examine joint dimensions and size materials to achieve required width to depth ratio. Adjust joint depths to allow sealant to perform properly.

03310.3.2.3 MATERIAL COMPATIBILITY - Verify that joint shaping materials and release tapes are compatible with sealant.

03310.3.3 CONSTRUCTION

03310.3.3.1 FEATURES AND PURPOSES OF JOINT CONSTRUCTION - Construct all joints as follows:

- At right angles to top surface of placement.
- Straight unless indicated otherwise.
- Before uncontrolled shrinkage cracking takes place.
- To prevent concrete edge slump.

03310.3.3.2 BOND BREAKER TAPE - Install where needed or required by manufacturer's recommendations to ensure that elastomeric sealant will perform properly.

03310.3.3.3 EXPANSION JOINTS - Expansion joints shall be constructed as follows:

- They shall be placed in locations as shown on the Drawings or as approved by the ENGINEER.
- Joints in exterior concrete slab work shall be placed where shown on Drawings or as recommended by Portland Cement Association's "Design and Control of Concrete Mixture Manual".

- Pre-molded filler strips shall extend full depth in slab.
- Unless otherwise noted on the Drawings or directed by the ENGINEER, isolation joints shall be used in all areas where slabs abut vertical surfaces. Joint material shall be placed as called for and in good alignment.
- In no case shall the reinforcing or other fixed metal items embedded in or bonded to concrete be made to run continuously through an expansion joint.
- Concrete edges at joints shall be neatly finished with an edging tool providing a slightly rounded edge on each side of the joint filler material.

03310.3.3.4 CONSTRUCTION JOINTS - Other references to construction joints are located in Subsection 03300.3.6.

03310.3.3.5 CONTROL JOINTS – Control joints shall be constructed as follows:

- **Tooled Joints.** Toolled joints shall be formed by scoring the slab full depth with a steel trowel along a straight edge in locations as shown on the Drawings or, if not shown, not to exceed 625 square feet in area. The joint shall be finished using a joint tool guided by a straight edge leaving a slightly rounded edge on each side of the joint.
- **Sawn Joints.** Sawn joints shall be sawn into interior concrete floors as indicated on the Drawings and at CONTRACTOR's option in place of pre-formed metal keys. Joints shall be sawn with a power saw designed to saw depth and width as shown on Drawings. Hand held saws will not be accepted. Saw cutting shall occur within 12 hours after placement of concrete. The line of the saw shall be straight, true to line and square. Pourable joint sealant shall be poured into all sawn joints. Installation shall be in strict accordance with manufacturer's specifications which shall include preparation, priming, etc.

03310.3.3.6 JOINT SEALING - Installation of joint sealant shall adhere to the following procedures:

- **Manufacturer's Instructions.** Application shall be in strict accordance with the manufacturer's published instructions.
- **Surface Preparation.** All surfaces to which synthetic rubber sealant must bond shall be dry and free of dust, dirt, and other foreign residue and shall be primed with the manufacturer's recommended primer for the particular surface. Remove all oil, grease, wax, form release agents, curing compounds, bitumen, old caulking, and other latent material by sand blast or water blast, as recommended by the sealant manufacturer. Maximum angle for sand blasting is 25 degrees \pm 5. Clean and dry with air blast. Do not contaminate air blast with oils or lubricants. Remove frost and moisture in concrete joint substrates before commencing sealing.
- **Installation.** If necessary, joints shall be saw cut, to provide the required sealant thickness and depth. Application shall be by means of a pneumatic caulking tool or other approved method. Ensure that sealant is installed in uniform, continuous ribbons without gaps or air pockets, with complete bonding of joint surfaces on opposite sides. Except as otherwise indicated, fill sealant rabbet flush with surface. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove so that joint will not trap moisture and dirt.

Install sealant to depths indicated or, if not indicated, as recommended by sealant manufacturer, but within the following general limitations measured at center (thin) section of bead:

- ⇒ For sidewalks, pavements and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.
- ⇒ For normal moving joints sealed with elastomeric sealants but not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but not more than 1/2 inch deep nor less than 1/3 inch deep.
- ⇒ For joints sealed with non-elastomeric sealants and caulking compounds, fill joints to a depth in the range of 75 percent to 125 percent of joint width.

- Overflow and Spillage. Do not allow poured sealant compound to overflow or spill onto adjoining surfaces or to migrate into voids of adjoining surfaces. Clean adjoining surfaces to eliminate evidence of spillage.
- Overheating. Do not overheat hot applied sealants.
- Exposed Edges. Unless indicated otherwise, recess exposed edges of gasket and exposed joint filler slightly behind adjoining surface so compressed units will not protrude from joints.

03310.3.3.7 CURING AND PROTECTION – The CONTRACTOR shall follow the steps listed below regarding curing and protection of sealant:

- Cure sealant and caulking compounds in accordance with manufacturer's instructions and recommendations to obtain high early bond strength, internal cohesive strength and surface durability.
- Follow procedures required for cure and protection of joint sealants during construction period so they will be without deterioration or damage (other than normal wear and weathering) at time of Substantial Completion.
- Protect joint sealant during and after curing period from contact with contaminating substances, or from damage resulting from deterioration through the time of Substantial Completion.
- If damage or deterioration occurs, immediately cut out and remove damaged or deteriorated joint sealant and reseal joint with new materials. Repaired area shall be indistinguishable from un-repaired area.

03310.3.3.8 CLEANUP - Clean off all excess sealant or sealant smears adjacent to joints as the work progresses. Use methods and cleaning materials approved by manufacturers of joint sealant and of the products in which joints occur.

03310.3.4 WATERSTOPS

03310.3.4.1 INSTALLATION - Waterstops shall be installed in concrete joints where and as indicated on the Plans. Waterstops shall be set accurately to the position and line indicated on the Plans. Where required at expansion joints, the hollow, centerbulb type waterstop shall be installed centered on the joint.

03310.3.4.2 CONTINUITY - All waterstops shall be continuous. Waterstops in walls shall be carried into lower slabs and shall join the waterstops in the slabs with appropriate types of fittings. Waterstops shall be terminated 3 inches from the top of finished surfaces of walls and edges of slabs unless otherwise specified or indicated on the Plans.

03310.3.4.3 FASTENING IN PLACE - Edges shall be held and securely fixed in position at intervals of not more than 24 inches to prevent movement during the placing of the concrete. Wires placed near the outer bulb and/or special clips may be used for this purpose, at the CONTRACTOR's option. No nails shall be driven through a waterstop in the vicinity of any construction joint.

03310.3.4.4 JOINTS – Waterstop joints shall meet the following requirements

- All waterstop joints shall be watertight.
- All joints shall be made by the use of factory-made fittings and unions, some of which will 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 may be used, at the option of the CONTRACTOR, provided that all junctions between standard solid type waterstop and split type waterstop shall be made with solidly welded and cemented unions between the two waterstops. This union may be split and re-cemented in accordance with the manufacturer's recommended method.
- 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 directions.

03310.4 METHOD OF MEASUREMENT

Unless otherwise indicated in these Specifications, no separate measurement will be made for the materials and work covered by this section.

03310.5 BASIS OF PAYMENT

Unless otherwise noted in these Specifications, no separate payment will be made for items under this section. Compensation shall be included in the prices paid for the various contract items and no separate compensation will be allowed.

03500.1 DESCRIPTION

This is a generic specification covering furnishing and installing of pre-cast concrete units, complete with required accessories as shown on the Drawings and called out in these Specifications.

03500.1.1 RELATED WORK

Section 01300 - Submittals
Section 02224 – Sewer Pipe and Manholes
Section 03050 - Portland Cement Concrete

03500.1.2 SUBMITTALS

03500.1.2.1 SHOP DRAWINGS - Submit shop drawings showing unit design, signed and sealed by a Professional ENGINEER, in accordance with Section 01300. The CONTRACTOR shall not proceed with fabrication until shop drawings have been approved.

03500.1.2.2 UNIT DESIGN – Unit design shall incorporate the following:

- Pre-cast units shall be designed in accordance with ACI 318 and PCA design handbooks under the direction of a Professional ENGINEER experienced in the design of such units.
- Indicate unit locations, unit identification marks, fabrication details, reinforcement, connection details, pertinent dimensions, and erection support points.
- Units shall be designed to support the required shipping and handling loads, and the live, dead and construction loads.
- Component connections shall be designed to provide adjustment to accommodate misalignment of structure during installation.
- The ENGINEER may approve design deviations provided that equivalent units serving the same basic function and intent are furnished at no additional cost to the OWNER. Such deviations shall only be approved upon written request and when accompanied with complete design calculations and drawings.

03500.1.3 DEFINITIONS

Not used.

03500.2 MATERIALS**03500.2.1 ACCESSORIES**

Connecting and supporting devices shall be carbon steel in accordance with ASTM A 36. Bolts, nuts and washers shall be carbon steel or stainless steel as required on the Drawings. Grade 60 reinforcement shall be provided for all units.

03500.2.2 IDENTIFICATION MARKS

Unit identification marks shall appear on all manufactured units.

03500.2.3 FINISHES

Shall be in accordance with one of the following paragraphs. If no finish is prescribed on the Drawings, the Standard Finish will be provided.

03500.2.3.1 STANDARD FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Small surface holes, normal form joint marks, minor chips and spalls may be approved. Major or unsightly imperfections, honeycomb or structural defects are not acceptable.

03500.2.3.2 COMMERCIAL FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Remove fins and large projections and fill holes over 1/2 inch with sand-cement paste. Faces shall be true and well defined. Exposed ragged edges shall be corrected by rubbing or grinding.

03500.2.3.3 ARCHITECTURAL GRADE FINISH - Produced in plastic or metal lined forms which impart a smooth finish. Fill holes over 1/4 inch in diameter with sand-cement paste. Grind smooth form offsets or fins over 1/8 inch. Coat with neat cement paste using a float and after paste has dried, rub with burlap to remove loose particles.

03500.2.3.4 SPECIAL FINISHES - Finishes produced by sandblasting, acid washing, or form liners shall be specifically defined on the Drawings or in these Specifications and samples showing texture and color will be required for approval.

03500.2.3.5 PAINTABLE FINISHES - Where unit surfaces will be painted, only form release agents compatible with paints shall be used during fabrication.

03500.3 CONSTRUCTION REQUIREMENTS**03500.3.1 FABRICATION**

Fabrication of pre-cast units shall proceed as follows:

03500.3.1.1 RECORDS - Maintain plant records and quality control program during production of structural pre-cast concrete. Make records available to ENGINEER.

03500.3.1.2 MOLDS - Use molds which are rigid and constructed of material that will result in uniform finished products.

03500.3.1.3 PLACEMENT AND VIBRATION - Place and vibrate concrete to ensure: proper consolidation, elimination of cold joints, and minimize entrapped air marks on finished surfaces.

03500.3.1.4 REINFORCEMENT AND FITTINGS - Provide required connecting devices, plates, angles, and connectors to steel framing members, bolts and accessories. Ensure reinforcing steel, anchors, inserts, plates, angles and other cast-in items are sufficiently embedded, anchored and properly located.

03500.3.1.5 LIFTING DEVICES - Embedded lifting or handling devices shall be capable of supporting units in positions anticipated during manufacture, storage, transportation and erection.

03500.3.1.6 FINISHED SURFACE - Ensure finished surfaces of pre-cast structural units are uniform.

03500.3.1.7 CURING - Cure units under identical conditions to develop specified concrete quality and minimize appearance of blemishes such as non-uniformity, staining or surface cracking.

03500.3.2 DELIVERY, STORAGE AND HANDLING

03500.3.2.1 DELIVERY - Unless otherwise approved in writing, do not deliver units to job site until required for installation.

03500.3.2.2 EDGE PROTECTION - Provide edges of units with adequate protection to prevent staining, chipping or spalling of concrete.

03500.3.2.3 HANDLING - Handle pre-cast units in positions consistent with their shape and design. Lift and support only from support points indicated on Shop Drawings.

03500.3.2.4 BLOCKING AND BRACING - Block and laterally brace units while in storage. Provide lateral bracing that is sufficient to prevent bowing and warping. Bracing shall be clean, non-staining and of a type that will not inhibit uniform curing of exposed surfaces.

03500.3.3 INSTALLATION

Do not install pre-cast units until concrete has attained its design compression strength. Install members plumb, level and in alignment. Clean weld marks or other marks, debris or dirt from exposed surfaces of units.

03500.3.4 REPAIR

Repair of damaged units may be acceptable if structural integrity or appearance is not impaired.

03500.4 METHOD OF MEASUREMENT

03500.4.1 NO MEASUREMENT

Separate measurement for pre-cast concrete units will not be made when the unit is a component of a building, assembly or enclosure for which identification is made in the Bid Schedule.

03500.4.2 SEPARATE MEASUREMENT

When pre-cast concrete units appear as a separate item on the Bid Schedule, they will be measured either by counting the number of units installed and accepted or by using a measuring tape or other accurate measuring device to determine the total number of lineal feet of units installed and accepted.

03500.5 BASIS OF PAYMENT

Separate payment for pre-cast concrete units will not be made when they are a component of building, assembly or enclosure identified in the Bid Schedule.

The accepted quantities will be paid for at the contract unit price for:

PAY ITEM	UNIT
Pre-Cast Concrete (<i>Describe</i>)	Each
Pre-Cast Concrete (<i>Describe</i>)	Lineal Foot

DIVISION 5

METALS



05010.1 GENERAL

This section of the Specifications covers metals and metal work required to furnish, fabricate, and to install the following nonexclusive list of items:

- Aluminum and miscellaneous nonferrous metals
- Anchors and anchor bolts
- Bolts
- Cast-iron frames and covers
- Grating and frames
- Ladders
- Louvers
- Manhole frames and covers
- Metal roof decking
- Miscellaneous metal items shown on the Plans or specified
- Miscellaneous structural steel
- Pipe handrails, pipe sleeves, inserts, and chains
- Platforms
- Sheet metalwork
- Special supports, hangers, and anchors
- Stairs and treads
- Steel lintels
- Supports for mechanical equipment
- Tread plates and frames

05010.1.2 RELATED WORK

Not used.

05010.1.3 SUBMITTALS

Certified copies, in duplicate, of mill tests or reports from a recognized commercial laboratory shall be furnished when requested as to the chemical, tensile, and bending properties of each shipment of structural metal or part thereof having common properties. All tests and analyses shall be made in accordance with the applicable ASTM Specification.

05010.1.4 DEFINITIONS

Not used.

05010.2 MATERIALS**05010.2.1 ALUMINUM**

05010.2.1.1 SHEET ALUMINUM - Except as otherwise specified or indicated on the Plans, sheet aluminum shall be alloy 50050H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.025 inch in thickness.

05010.2.1.2 STRUCTURAL ALUMINUM - Structural aluminum shall be 6061-T6, and extruded aluminum shall be 6063-T42. Aluminum shapes and appurtenant materials shall conform to the requirements of ASTM B 221 and ASTM B 308 and shall be of aluminum alloy known commercially as 6061-T6. Materials not otherwise specified shall conform to the latest applicable Specifications of ASTM.

05010.2.1.3 BOLTS - All bolts for bolting aluminum shall be Type 304 or 316 stainless steel of sizes indicated on the Plans.

05010.2.2 STEEL

05010.2.2.1 SHEET STEEL - Galvanized sheet iron or steel shall conform to ASTM A 525, 1.25-ounce coating; black steel to ASTM A 569.

05010.2.2.2 STRUCTURAL STEEL – Structural steel shall be as follows:

- Unless otherwise specified, structural steel shall conform to ASTM A 36.
- Cast iron shall conform to ASTM A 48, Class 40B.
- Galvanized structural steel or iron shall be “hot dipped” galvanized after fabrication. Electro-galvanizing shall not be used unless specified otherwise.
- All structural steel shall be delivered free from mill scale, rust, or pitting.
- Items not galvanized or protected by a shop coat of paint shall be protected from the weather until erection and painting.

05010.2.2.3 STAINLESS STEEL - Stainless steel, unless specifically specified or indicated on the Plans otherwise, shall be Type 316 or Type 304, nonmagnetic.

05010.2.2.4 STEEL PIPE - Steel pipe shall conform to ANSI B 36.10, Table I.

05010.2.2.5 BOLTS - High tensile bolts shall conform to ASTM A 325.

05010.2.2.6 OTHER ITEMS

Other structural and miscellaneous metal items shall be as indicated on the Plans or as specified elsewhere.

05010.3 CONSTRUCTION (FABRICATION) REQUIREMENTS

05010.3.1 GENERAL

All structural or foundry items shall be carefully fabricated to true dimensions without warp or twist. Welded closures shall be neatly made; and where weld material interferes with fit or is unsightly in appearance, it shall be ground off smooth.

05010.3.1.1 INSTALLATION - Each structural item shall be installed true to level, plumb, alignment, and grade with all parts bearing or fitting the structure or equipment for which it is intended accurately and securely. It shall not be permitted to cock out of alignment, re-drill, reshape, or force to fit any fabricated item. It is the CONTRACTOR’s responsibility to place anchor bolts or other anchoring devices accurately and to make any surfaces, which bear against structural items smooth and true to level to preclude the necessity of any springing, re-drilling, or reshaping.

05010.3.1.2 SPECIAL ALIGNMENT - Pipe railings, posts, and structural items needing a special alignment to preserve straight, level, even, smooth lines shall be rigidly supported and braced and kept braced until concrete, grout, or dry pack cement mortar has hardened for a period of not less than 48 hours.

- 05010.3.1.3 FIT - The CONTRACTOR shall be responsible for the correct fitting of all metalwork in the field. The CONTRACTOR shall take all measurements necessary to properly fit its work in the field, and it shall be governed by and be responsible for these measurements and the proper working out of all details.
- 05010.3.1.4 WELDING – General welding procedures are as follows (see also Subsections below):
- The CONTRACTOR shall notify the ENGINEER at least 24 hours before starting shop or field welding.
 - A welding inspector may check the materials, the equipment, and the qualifications of the welders.
 - The inspector may use gamma ray, magnetic particle, dye penetrant, trepanning, or any other aid to visual inspection which it may deem necessary to be assured of the adequacy of the welding.
 - The costs of any tests and all re-tests on defective welds shall be borne by the CONTRACTOR. Cost in connection with qualifying welders shall also be borne by the CONTRACTOR.
 - The cost of tests on sound welds will be borne by the OWNER.
 - Welders doing unsatisfactory work shall be removed or may be required to pass qualification tests again.
- 05010.3.1.5 MISCELLANEOUS METALWORK - Where anchors, connections, or other details of miscellaneous metalwork are not definitely shown or specified, its material, size, form, attachment, and location shall conform to best practice.
- 05010.3.1.6 HAZARDOUS PROJECTIONS - Sharp or hazardous projections shall be rounded off and ground smooth.
- 05010.3.1.7 CHIPS AND DEBRIS - All chips and other debris lodged between contacting surfaces shall be removed before assembly.
- 05010.3.2 ALUMINUM
- 05010.3.2.1 STRUCTURAL ALUMINUM
- The CONTRACTOR shall furnish and install all structural aluminum items in accordance with the Plans and as specified. It shall provide all supplementary parts necessary to complete each item even though such work is not definitely covered by the Plans and Specifications. Its size, form, attachment, and location shall be such as to conform to the best of current practice.
- 05010.3.2.2 LAYOUT ON ALUMINUM - Hole centers may be center punched and cutoff lines may be punched or scribed. Center punching and scribing shall not be used where such marks would remain visible on the surface of the fabricated material.
When critical dimensions exist, a temperature correction shall be applied in the layout as necessary. The coefficient of expansion shall be taken as 0.00013 per degree F.
- 05010.3.2.3 CUTTING AND DRILLING ALUMINUM – Aluminum may be cut and drilled as follows:

- Material 1/2 inch thick or less may be sheared, sawed, or cut with a router. Material more than 1/2 inch thick shall be sawed or routed.
- Cut edges shall be true, smooth, and free from excessive burrs or ragged breaks.
- Edges of plates carrying calculated stresses shall be planed to a depth of 1/4 inch. Sawed or routed edges will be acceptable when the finish is of equal quality to a planed edge.
- Re-entrant cuts shall be avoided wherever possible. If used, they shall be filleted by drilling prior to cutting.
- Rivet or bolt holes may be punched or drilled to finished size before assembly.
- The finished diameter of holes for unfinished bolts shall be not more than 1/16 inch larger than the nominal bolt diameter.
- All holes shall be cylindrical and perpendicular to the principal surface. Holes shall not be drifted in such a manner as to distort the metal.
- Flame cutting of aluminum alloys is not permitted.

05010.3.2.4 ALUMINUM FORMING AND ASSEMBLY - Structural aluminum material may not be heated except in forming operations where material may be heated to a temperature not exceeding 400 degrees F for a period not exceeding 30 minutes to facilitate bending. Such heating shall be done only when proper temperature controls and supervision are provided to insure that the limitations on temperature and time are carefully observed.

05010.3.2.5 WELDING ALUMINUM - This Specification shall apply to both field and shop welding operations. The general recommendations and regulations shown in the American Welding Society Specifications D1.1, "Structural Welding Code," apply to 6061-T6 structures. Detail requirements for welding aluminum alloy 6061-T6 are given as follows:

- Filler metal for welding shall be aluminum alloy welding rods conforming to the requirements of AWS A 5.10 and shall be AWS classification ER 4043, ER 5154, ER 5254, ER 5183, ER 5356, or ER 5556.
- The welding process and welding operators shall both meet a qualifications test. The method of qualification shall conform to the method described in the ASME Boiler and Pressure Vessel Code, Section IX, "Welding Qualifications," Part B. Aluminum alloy 6061-T6 shall be used for the qualification test plates. Operators shall be qualified on the basis on bend tests and a fillet weld soundness test.
- Dirt, grease, forming or machining lubricants, or any organic materials shall be removed from the areas to be welded by cleaning with a suitable solvent or by vapor degreasing. Additional operations to remove the oxide coating just prior to welding are required when the inert gas tungsten arc welding method is used. This may be done by etching or by scratch brushing. The oxide coating may not need to be removed if the welding is done with the automatic or semi-automatic inert gas shielded metal arc.
- Suitable edge preparation to assure 100 percent penetration in butt welds shall be used. Oxygen cutting shall not be used. Sawing, chipping, machining or shearing may be used.
- Any welding of aluminum shall be done using a nonconsumable tungsten electrode with filler metal in an inert gas atmosphere (TIG) or using a consumable filler metal electrode in an inert

gas atmosphere (MIG). No welding process that requires the use of a welding flux shall be used unless prior approval has been obtained from the ENGINEER. Preheating for welding is permissible provided the temperature does not exceed 400° F for a total time of 30 minutes.

- Welding of any structure which is to be anodized shall be done using filler alloy rods that will not discolor when anodized. ER 5154, ER 5254, ER 5183, ER 5356, or ER 5556 filler alloy rods shall be used.

05010.3.2.6 PROTECTION OF ALUMINUM SURFACES - Aluminum surfaces to be placed in contact with wood, concrete, masonry, or dissimilar metals other than stainless steel shall be protected as specified in the appropriate sections of Division 9 – Finishes.

05010.3.2.7 BOLTING - Where aluminum comes in contact with steel it shall be bolted with stainless steel bolts and separated or isolated from the steel with neoprene gaskets or washers or as specified in Division 9.

05010.3.3 STEEL

05010.3.3.1 STRUCTURAL STEEL – The following shall apply:

- The CONTRACTOR shall furnish and install all structural steel items in accordance with the Plans and as specified herein.
- The CONTRACTOR also shall provide all supplementary parts necessary to complete each item even though such work may not be specifically covered by the Plans and Specifications.
- Wherever applicable, all fabrication and erection of steel items shall conform to AISC “Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings” except as the same may be modified by applicable building codes, the General Conditions, and these Specifications.

05010.3.3.2 WELDING OF STEEL – Both the general recommendations and regulations shown in the American Welding Society Specifications D1.1, “Structural Welding Code,” as well as the detail requirements in those specifications apply to welding of steel structures. Welding of steel shall adhere to the following:

- All welding of steel under this section shall be done by welders who have a current AWS certificate for the type of welding to be done by the welder.
- All welding of structural steel type ASTM A 36 shall be done using mild steel covered Arc Welding Electrodes conforming to ASTM A 233, Series E70, or shall be done using Electrodes and Fluxes for Submerged Arc Welding conforming to ASTM A 558, Classification F70-XXXXX, where XXXXX refers to any electrode referred to in ASTM A 558.
- Welding of stainless steels shall be done with electrodes and techniques as recommended in Welded Austenitic Chromium - Nickel Stainless Steels - Techniques and Properties as published by the International Nickel Company, Inc., New York, New York. All welds shall be full penetration welds, unless specified otherwise.

05010.3.3.3 PROTECTION OF STEELWORK - The CONTRACTOR shall paint steel and miscellaneous ferrous metal items as specified in the appropriate sections of Division 9-Finishes.

05010.3.4 DUCTWORK

- 05010.3.4.1 **DESIGN AND FABRICATION** - Ducts shall be fabricated of aluminum or galvanized steel sheets with gauges of sheet metal, joint types, reinforcing, bracing, supporting, fabricating, installing, and other requirements in accordance with Duct Manual and Sheet Metal Construction for Ventilating and Air Conditioning Systems of the Sheet Metal and Air Conditioning Contractors National Association, Inc. Ducts shall be designed for the appropriate pressure type as shown in the above mentioned Duct Manual. Details on the Plans in some cases call for sheet metal thicknesses greater than called for in the Duct manual. Sheet metal shall conform to whichever requirement calls for the greater thickness. Aluminum ducting shall be not less than 0.063 inches thick.
- 05010.3.4.2 **HANGERS** - Ducts shall be supported on both sides at all changes in direction and at not greater than eight foot intervals by suitable hangers as specified herein or as detailed on the Plans. For galvanized ducting, hangers for ducts 12-inch by 24-inch or smaller shall be galvanized sheet metal straps not lighter than 18-gauge by one inch secured to the structure by one 5/16-inch bolt and to the duct by not less than two No. 10 sheet metal screws or 3/16-inch stove bolts. Hangers for ducts larger than 12-inch by 24-inch shall be galvanized steel straps or rods not less than 0.13 square inches in net cross section, secured to the structure by a Grinnell Figure 152, Size 2, concrete insert, or approved equal, and to a duct pocket or reinforcing angle by two 1/4-inch stove bolts. For aluminum ducting, supports shall be equivalent to supports for galvanized ducting except that all fasteners, fittings, and shafting shall be stainless steel.
- 05010.3.4.3 **FLEXIBLE CONNECTIONS** - Where blowers or equipment containing blowers or other machine elements, which may cause vibration, are connected to ducts or housing, such connections shall be by means of flexible connections. These flexible connections shall be airtight at the pressures encountered and be flame proof and water proof. The flexible material shall be equivalent to 14 ounce canvas.

05010.4 METHOD OF MEASUREMENT

Not used.

05010.5 BASIS OF PAYMENT

Not used.

05050.1 DESCRIPTION

This section covers a generic list of miscellaneous metals specifications.

05050.1.1 RELATED WORK

Not used.

05050.1.2 SUBMITTALS

Not used.

05050.1.3 DEFINITIONS

Not used.

05050.2 MATERIALS**05050.2.1 LADDERS AND METAL STAIRS**

All ladders shall be safety ladders conforming to OSHA standards. All ladders and stairways supplied to the project shall be of one manufacturer. All stair and ladder wells shall be adequately guarded, and all stairs shall have handrails as specified or shown on the Plans.

Ladders shall be secured to the supporting surface by bent plate chips providing not less than 7 inches between the supporting surface and center of rungs. If exit from the ladder is forward, over the top rung, side rails shall be extended not less than 3-feet-3 inches above, and returned to the landing. If exit from the ladder is to the side, the ladder shall extend not less than 5-feet 6-inches above the landing and be rigidly secured at the top.

05050.2.2 ALUMINUM LADDERS

Aluminum ladders shall be made of 6063-T5-aluminum alloy, of welding construction. Rungs shall be not less than 1-inch square bar with 1/8-inch grooves in the top and redivided edges. Side rails shall be no lighter than 3 inches by 3/8 inches. Ladders shall be of the size, shape, location, and details indicated on the Plans. Ladders greater than 20 feet in height shall have standard ladder cages designed in accordance with State and OSHA requirements. All aluminum surfaces, which will be in contact with concrete, shall be coated as specified in Division 9.

05050.2.3 ALUMINUM STAIRWAYS

Aluminum stairways shall be fabricated and installed as shown on the Plans. Stairway stringers shall be fabricated of aluminum alloy 6061-T6. Treads shall be aluminum as specified below. Handrail shall be fabricated of aluminum pipe as specified under aluminum handrail.

Stair treads shall be aluminum of the sizes called for on the Plans, and shall be of the same type and make as called for under GATING. All fasteners shall be of Type 304 or 316 stainless steel.

Stair treads shall be furnished with cast abrasive type safety nosing.

05050.2.4 ARCHITECTURAL AND MISCELLANEOUS SHEET METAL

Sheet metal flashing and counterflashing shall be installed as indicated on the Plans. Galvanized steel or anodized aluminum flashing shall be used when indicated and specified on the Plans.

Unless otherwise indicated flashing shall be 0.025-inches thick. The aluminum flashing shall receive a 215-R1 anodic finish after fabrication as indicated on the Plans. Exposed edges shall be folded back 1/2-inch to provide stiffness. Except as otherwise indicated and specified on the Plans, counterflash shall be provided over all base flashings.

Unless specifically noted, galvanized steel flashing shall be used in contact with structural steel and anodized aluminum flashing shall be used in contact with structural aluminum. This shall be done to protect against dissimilar metal action.

Surfaces to which sheet metal is to be applied shall be even, smooth, round, thoroughly clean and dry, and free from all defects that might affect the application. All cutting, fitting, drilling, and other operations in connection with sheet metal required to accommodate the work of other trades shall be performed under this section. All accessories or other items essential to the completeness of this sheet metal installation, though not specifically shown or specified, shall also be provided under this section. Nails, screws, and bolts shall be of the types best suited for the intended purpose and shall be of a composition that will not support galvanic action in the installation. Where sheet metal abuts into adjacent materials, the juncture shall be executed in a manner satisfactory to the ENGINEER.

Sheet metal items not covered elsewhere shall be as indicated on the Drawings and as required to provide a watertight installation. Formed sheet metal for metal covered work shall accurately reproduce the detail and design shown and profiles, bends, and intersections shall be sharp, even, and true.

05050.2.5 ALUMINUM SHEET METAL WORK

Except as otherwise specified or indicated on the Plans, sheet aluminum shall be alloy 5005-H14 conforming to the requirements of ASTM B 209 and shall be not less than 0.025 inch in thickness and extruded aluminum shall be 6063-T42.

05050.2.6 MISCELLANEOUS STRUCTURAL STEEL

Miscellaneous steel items not specified herein shall be as shown on the Plans or specified elsewhere and shall be fabricated and installed in accordance with the best practices of the trade.

05050.2.7 LINTELS

Lintels for masonry construction shall be structural steel beams or angles, fabricated as indicated on the Plans.

05050.2.8 SUBMERGED ASSEMBLY BOLTS

Assembly bolts for wood baffles, collectors, and other assemblies in areas where stainless steel anchor bolts would be required shall be stainless steel bolts Type 304 or 316.

05050.2.9 ANCHOR BOLTS AND INSERTS

Wherever feasible, anchor bolts shall be cast in place when concrete is placed.

All anchor bolts and concrete anchors embedded in concrete shall be accurately spaced with bolts truly normal to the surfaces from which they project. Type 304 or Type 316 stainless steel anchor bolts and nuts shall be used under these circumstances:

- Any time they are submerged in water.

- In the case of structures customarily containing water, placed in walls, ceilings, or overheads, even if above water level.
- In the dry side of water bearing walls.
- Where securing aluminum to steel or concrete.

Anchor bolts not required by above conditions to be of stainless steel, may be of carbon steel conforming to ASTM A 307 or ASTM A 36. Carbon steel anchor bolts in the following locations shall be hot-dip galvanized.

- Anchor bolts exposed to the weather.
- In electrical manholes or pull boxes.
- In tunnels, passageways, galleries, vaults, or rooms below grade or enclosed in part by water bearing walls.

In anchoring machinery bases subject to heavy vibration, two nuts shall be used, one serving as a locknut. In all cases where steel anchor bolts are used, a liberal coating of nonoxidizing wax shall be applied to the threads before screwing on nuts.

All bolts, when indicated for future use, shall be first coated thoroughly with nonoxidizing wax, followed by turning nuts down to the full depth of thread. Exposed thread shall then be neatly wrapped with a waterproof polyvinyl tape.

05050.2.10 **INSTALLATION**

Anchor bolts shall be embedded not less than 12 diameters. Where shown on the Plans, anchor bolts shall be set in metal sleeves having an inside diameter approximately 3 times the bolt diameter and not less than 12-bolt diameters in length. Sleeves shall be filled with grout when the machine or other equipment is grouted.

05050.2.11 **CONCRETE ANCHORS**

Concrete anchors, where indicated on the Plans or specified, shall mean drilled in place anchors with integral anchor bolts. Concrete anchors shall be Phillips “Wedge Anchors” with integral anchor bolts, or Expansion Products Company “Wej-It” concrete anchors with integral anchor bolts, or approved equal.

The material of each concrete anchor, including its integral anchor bolt, shall be the same material as would be required, under these Specifications, for anchor bolts in the same location that the concrete anchor is to be used.

Concrete anchors shall have the following minimum embedment lengths:

EMBEDMENT OF CONCRETE ANCHORS

Size	Embedment Length
3/8”	1-1/2”
1/2”	2-1/4”
5/8”	2-3/4”
3/4”	3-1/4”

If Wej-It expansion anchors are used they shall have the following minimum embedment length:

WEJ-IT ANCHORS

Size	Embedment Length
1/4"	1-1/2"
1/2"	5"
5/8"	5"
3/4"	5"

Anchor bolts, of the same material and size as required for the specified concrete anchors, may be cast in the concrete in lieu of using concrete anchors. Embedment of bolts in concrete shall be not less than 12-bolt diameter plus a standard hook.

No cast iron, lead cinch, or slug-in anchors will be permitted for use.

05050.2.12 MISCELLANEOUS CAST IRON

All castings shall be tough, gray iron, free from cracks, holes, swells, and cold shuts, and be of workmanlike finish, and shall conform to the Standard Details and with the ASTM Specification Designation A 48, Class 40 B. The quality shall be such that a blow from a hammer will produce an indentation on a rectangular edge of the casting without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned and subjected to a hammer inspection, after which they shall receive a coating of coal-tar pitch varnish in such a manner as to form a firm, tenacious coating.

05050.2.13 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be made from a superior quality gray iron, conforming to the requirements of ASTM A 159, Class G3000, or ASTM A 48, Class 30-B. Frames and covers shall have horizontal and vertical bearing surfaces machined to fit neatly, and the cover shall bear firmly in the frame without rocking and shall be easily removable. Frames and covers shall be heavy-duty traffic type designed for H-20 loading and shall have a combined set weight of at least 265 pounds.

Frames shall have a clear inside opening of 24 inches diameter and shall be of the bottom flange type. Frame height shall be approximately 4 1/2" and bottom flange outside diameter shall be approximately 32 inches.

Covers shall have a skid resistant grid pattern design as recommended ASTM publication STP326.

The elevations at which manhole frames and covers are to be set shall conform to the requirements set forth on the Plans, but in all cases shall be governed by the ENGINEER in the field. Where the cover is in existing pavement or in the traveled way of the existing road shoulder, it is to be placed flush with the existing surface. Where the structure is outside the limits of the traveled shoulder but not in the roadside ditch, it should be placed 1/10 foot or more above the existing ground surface. Where the manhole cover falls in the existing roadside ditch or right of way, it is to be placed approximately 1-1/2 feet above the existing ground surface or as directed by the ENGINEER. Manhole frames shall be set at the required grade and shall be securely attached to the top precast manhole shaft unit. After the frames are securely set in the place provided herein, covers shall be installed and all necessary cleaning and scraping of foreign materials from the frames and covers shall be accomplished to ensure a fine satisfactory fit. All costs of setting and securing manhole frame and cover sets in place as herein provided, including

all necessary concrete work shall be considered as included in applicable contract unit prices and no additional allowance will be made therefor.

Cast lettering on manhole covers shall be as shown on the Plans. Shop drawings of all manhole rings and covers shall be submitted to the ENGINEER.

05050.2.14 CAST IRON PRESSURE MANHOLE FRAME AND COVER

The CONTRACTOR shall furnish and install, ready for use as indicated on the Plans and as specified herein, rectangular pressure manholes and covers. Each pressure manhole shall have a clear opening of 18" X 30". The pressure plate shall be flat on top and shall not be less than 1/2 inch thick steel and fastened with 316 stainless steel studs and stainless steel nuts. A 1/8-inch thick neoprene gasket shall be supplied between the frame and pressure plate. Lifting shall be provided with a watertight pickhole. The frame shall be a seal-type with flanges at the base and at the top.

05050.2.15 MISCELLANEOUS ALUMINUM

Structural and other metal items fabricated from aluminum, not covered separately herein shall be fabricated in accordance with the best practices of the trade and shall be field assembled by riveting or bolting with no welding or flame cutting permitted except as approved by the ENGINEER.

05050.2.16 ALUMINUM STAIR NOSING

Stair nosings shall be installed on all treads of all concrete stairs including the top tread of the upper slab. Stair nosings shall be aluminum abrasive cast nosings with aluminum oxide granules integrally cast into the metal forming a permanent nonslip long wearing surface. The nosings shall be Type 101 Stair Tread by Wooster Products, Inc., Spruce Street, Wooster, Ohio 44691, Type A stair treads by American Abrasive Metals Company, or approved equal. The treads shall have integrally cast anchors. Stair nosings shall be cast in fresh concrete and shall be flush with the tread and riser faces. Stair nosing shall be coated with zinc chromate primer in accordance with the provisions of Division 9. Screws shall be 304 or 316 stainless steel.

05050.2.17 MANHOLE STEPS

Manhole steps shall consist of 3/4-inch diameter stainless steel or polyethylene rungs. Rungs shall extend 7-inches from the face of the wall to which they are anchored and shall have a minimum clear width of 16-inches. Rungs shall be designed such that the foot cannot slide off the end. Distance between rungs shall be 12-inches. Rungs shall be hook anchored into walls a minimum of 6-inches.

05050.3 CONSTRUCTION REQUIREMENTS

Not used.

05050.4 METHOD OF MEASUREMENT

Not used.

05050.5 BASIS OF PAYMENT

Not used

DIVISION 8
DOORS AND WINDOWS



SPECIAL PROVISION

EMBEDDED ACCESS HATCH

**SECTION
08122SP**

08122.1 DESCRIPTION

The CONTRACTOR shall furnish and install embedded access hatches and associated fittings in designated structures in accordance with the Drawings and these Specifications.

08122.1.1 RELATED WORK

Section 03300 – Concrete Structures and Slabwork

08122.1.2 SUBMITTALS

08122.1.2.1 DESCRIPTIVE LITERATURE - Descriptive literature which identifies the manufacturer, model number, size and materials of fabrication for all equipment and materials furnished under this section shall be provided by the Drawings in accordance with Section 01300 of these Specifications.

08122.1.2.2 CERTIFICATION OF COMPLIANCE - Certification of compliance with the standards and Specifications contained herein shall be obtained from the manufacturer and provided by the CONTRACTOR at the time of delivery of these materials to the project site.

08122.1.3 DEFINITIONS

Not used

08122.2 MATERIALS

08122.2.1 QUALITY CONTROL

This Specification is not intended to be exclusive or limit competition, but rather to set forth the minimum standards for quality and performance. The OWNER reserves the right to reject substitutions if, in his opinion, the proposed substitutions will not achieve comparable equipment installation and performance standards.

08122.2.2 HATCH

The embedded access hatch shall be as manufactured by the Syracuse Castings West, or approved equal. The model number or type shall be shown on the Drawings, but as a minimum shall be equal to a Model FTP-WT-8, as applicable. Material shall be 6061-T6 aluminum for bars, angles and extrusions. 1/4" diamond plate shall be 5086 aluminum. Unit designed for 150 lbs S/F with a deflection of no greater than 1/150th of the span. Cover shall be equipped with a stainless steel automatic hold open arm. To highlight this safety device, the hold open arm must be supplied with a red powder coat finish. Door shall lock open in the 90-degree position. Hold open arm shall be fastened to the frame with a 1/2" grade 316 stainless steel bolts. Hold open arms not supplied with complete red powder coat finish shall not be considered equal. For ease of operation when opening cover, each cover shall be supplied with a heavy duty, stainless steel pneu-spring. Spring must consist of a minimum 1/2" stainless steel shaft which slides into a minimum 1" stainless steel tube. Spring must be charged with an inert gas (nitrogen). Mechanical, torsion, or coil type springs shall not be accepted as equal. Spring design must ensure ease of maintenance. Angle frame shall be of extruded aluminum, shall be 4" tall with a 4" wide bottom-mounting flange. Angle frame shall be a minimum of 1/4" thick. Unit supplied with factory installed skirt to match 8" slab thickness of the new concrete roof. Skirt must incorporate a "Water Stop Flange" to keep water from seeping between hatch frame and top of structure. Hatch shall be cast in top roof slab, while still allowing 4" of the hatch frame to protrude above the structure. Any

SPECIAL PROVISION

EMBEDDED ACCESS HATCH

**SECTION
08122SP**

hatch NOT supplied with the integral skirt and water stop flange shall not be accepted as equal. Hinges shall be of heavy-duty design. Material shall be stainless steel with a 3/8" grade 316 stainless steel pin. Hinges shall be bolted to the angle frame and diamond plate, with grade 316 stainless steel bolts and ny-lock nuts.

Aluminum hinges, or stainless steel hinges not utilizing a 3/8" diameter stainless steel pin shall not be considered as equal. Hinge hardware must be supplied with 1/4" plate over the fasteners to act as a guard against tampering. No fastener heads can be visible from exterior of access hatch. The gasket shall be "Rimseal" gasket with 11mm compressible bulb. Gasket is required to have minimum 11mm compressible bulb so that contact between the cover and frame is assured. Flat gaskets shall not be accepted as equal. Lift handle shall be aluminum and fastened to edge of 2" turn-down (on the cover) by recessed stainless steel screws. All other misc hardware shall be stainless steel. Hatch cover shall be supplied with a 2" vertical turn-down welded to the edge of the plate cover to negate the possibility of any surface water from entering between hatch cover and "Rimseal" gasket. Cover shall have a "continuous weld" where 2" turn-down meets 1/4" plate cover. Each hatch shall be supplied with a padlock lug, mounted to the front side of the hatch frame and cover for owner's padlock. Padlock lug must be protected by an aluminum shroud. Aluminum shroud is meant to protect padlock from weather, as well as provide additional measure of tamper resistant security. Aluminum shroud must have a "roof" as well as side shields. Any hatch not supplied with the protective shroud shall not be accepted as equal. Exterior of hatch frame shall utilize (as an isolation coating, to deter reaction of dissimilar materials) "Tufcoat 3.5PR" Industrial Coatings by Dupont at a thickness of 3 mils. Application procedure shall be as recommended by Dupont. Isolation coatings shall not be substituted.

08122.2.3 HARDWARE

Hardware shall be stainless steel. Installation shall be in accordance with manufacturer's instructions. Manufacturer shall guarantee against defects in material or workmanship for a period of five years.

08122.3 CONSTRUCTION REQUIREMENTS

The CONTRACTOR shall install all equipment and components under this section in accordance with the manufacturer's installation instructions, the Drawings and these Specifications. Where instructions are unavailable or unnecessary, the CONTRACTOR shall at all times use good workmanship practices, applicable building codes, and regulations. The CONTRACTOR shall supply and install all miscellaneous fittings required to provide a complete operating system or component, as applicable.

08122.4 METHOD OF MEASUREMENT

08122.4.1 NO MEASUREMENT

Unless a separate bid item for furnishing and installing the work outlined in this Section is provided in the Bid Schedule, this work shall not be measured for separate payment, but shall be considered incidental to other items in the Bid Schedule.

08122.4.2 SEPARATE MEASUREMENT

Where items installed under this section are listed separately in the Bid Schedule, the items shall be measured by counting the number of units installed and accepted.

SPECIAL PROVISION

EMBEDDED ACCESS HATCH

**SECTION
08122SP**

08122.5 BASIS OF PAYMENT

Complete compensation for the accepted work outlined in this Section shall be included in other bid items when no separate bid item is provided in the Bid Schedule for this work.

When a separate bid item is provided in the Bid Schedule, complete compensation for this accepted work shall be included in the contract unit price on the Bid Schedule.

PAY ITEM	UNIT
Embedded Access Hatch (<i>Type</i>)	Each

DIVISION 13
SPECIAL CONSTRUCTION



SPECIAL PROVISION

SPRING DEVELOPMENT

**SECTION
13810SP**

13810.1 DESCRIPTION

13810.1.1 Includes furnishing all labor, material, and equipment required to complete the development of a spring located as shown on the DRAWINGS.

13810.1.2 The intent of this WORK is to expose the water bearing strata within the designated area of the spring and to capture all of the water borne by that strata. Because of the variations which can occur in geologic formations, unknown conditions may occur which will require deviation from the development plans indicated on the DRAWINGS. As excavation in the spring area proceeds, the ENGINEER will be on-site to provide interpretation and determine the extent of excavation required to capture the spring water. Should changes of quantities occur during this excavation, the procedure prescribed in Part 13 of Section 00700 "GENERAL CONDITIONS" for making such changes shall be followed.

13810.1.3 RELATED WORK

Section 02105 - Earthwork Materials
Section 02200 - Trench Excavation and Backfill
Section 02222 - Waterline Pipe Installation
Section 15110 - Pipe and Piping Systems
Section 15230 - Waterline Valves and Hydrants
Section 03100 - Concrete Forming, Finishing and Curing
Section 03500 - Pre-Cast Concrete Components

13810.1.4 SUBMITTALS

13810.1.4.1 All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall accompany each delivery of material.

13810.1.4.2 The CONTRACTOR shall submit for review complete information showing all materials to be used in the spring development, including but not limited to: 40 mil plastic liner, geotextile filter fabric, bentonite clay, washed gravel, rip-rap, concrete, and piping.

13810.2 MATERIALS

13810.2.1 All materials coming into contact with the spring water shall comply with National Sanitary Foundation (NSF) Standard 61 and be imported from a site approved by the ENGINEER.

13810.2.2 Water Piping - Water piping shall be of the size and type as shown on the DRAWINGS and in accordance with Sections 02222 and 15110.

13810.2.3 Collection Lines - Piping for collection lines shall be PVC C-905, Class 150 pipe or PVC Class 160 Pressure Rated pipe meeting the requirements of ASTM D2241 of the size shown on the DRAWINGS and perforated with 3/4-inch holes spaced 2-inches apart, on top portion of pipe.

13810.2.4 Valves - Valves for water piping shall be in accordance with Section 15230.

13810.2.5 POLYETHYLENE LINER. The polyethylene liner shall be produced from a pipe grade high-density polyethylene (HDPE) resin and have a minimum thickness of 40 mils. It shall be NSF approved.

13810.2.6 Bentonite Clay - Bentonite clay shall be commercially manufactured bentonite clay for water sealing, and packaged in 80 lb. bags to prevent contamination.

SPECIAL PROVISION

SPRING DEVELOPMENT

**SECTION
13810SP**

13810.2.7 Concrete - Concrete shall be in accordance with Section 03050 and 03100. Pre-cast concrete enclosures and manholes shall be in accordance with Section 03500.

13810.2.8 RIP-RAP. Rip-rap shall be hard, durable, angular in shape, resistant to weathering and to water erosion, free from overburden, spoil, shale and organic debris. Rip-rap gradation shall meet the following requirements unless otherwise acceptable to the ENGINEER and OWNER.

<u>Stone Size</u>	<u>Percent Passing</u>
12"	100%
8"	50%
6"	25%
4"	0%

13810.2.9 Gravel for Drains & Foundations - Gravel for drains and foundations shall be in accordance with Section 02105.

13810.3 CONSTRUCTION REQUIREMENTS

13810.3.1 Excavation within the spring area shall not proceed until the ENGINEER or a designated representative is present. Clearing and grubbing within the spring area must be completed prior to starting any excavation.

13810.3.2 Equipment capable of operating in extremely wet and unstable conditions shall be provided for developing the spring. Excavation in the spring area shall be accomplished with 225 track mounted (or larger) backhoe.

13810.3.3 As the water bearing strata is exposed, the CONTRACTOR shall provide necessary protective measures to prevent contamination with excavated topsoil, surface debris or fuels and equipment lubricant, etc.

13810.3.4 Before placing polyethylene liner, the exposed ground surface will be prepared so that no sharp rocks will be in contact with the fabric or sheeting.

13810.3.5 When the ENGINEER has decided the extent of the water bearing strata, provisions will be made to accommodate resulting water flow and then the cut-off wall shall be installed in accordance with the details shown on the DRAWINGS.

13810.3.6 Following installation of the cut-off wall, collection lines and drain gravel, the polyethylene liner shall be placed over the filter and backfill can proceed. Care shall be taken so that sources of contamination (i.e. animal or vegetative matter, surface debris) are not placed with the backfill.

13810.3.7 When backfilling proceeds to the level shown on the DRAWINGS, the polyethylene liner shall be placed over the entire filter area in a manner so that its edges extend at least fifteen feet beyond the edge of the filter zone and its top surface will slope so that any water will not be accumulated on its surface. At least 24-inches of backfill shall then be placed over the covered filter area. Backfill material shall be sorted during placement to assure that no large or sharp rocks are placed against the polyethylene liner.

13810.3.8 Compaction of backfilled material over the spring collection area shall consist only of wheel rolling sufficiently to support backfilling and grading equipment.

13810.3.9 Finish grading and shaping of the backfilled material shall be done in a manner that surface water drainage will occur away from spring collection area.

SPECIAL PROVISION

SPRING DEVELOPMENT

**SECTION
13810SP**

13810.3.10 Finishing and clean up of the spring development area shall include removal of any deep rooted vegetation, trees, brush and other objectionable material.

All debris and vegetative waste materials accumulated from spring development shall be removed from the site and suitably disposed of at the CONTRACTOR's expense. The CONTRACTOR shall make the required arrangements with State or local authorities for disposal of these materials.

13810.4 METHOD OF MEASUREMENT

13810.4.1 Spring Exploration/Development shall be measured by the hour of operation of the excavating machine (with an operator) and includes all investigation and excavation required to locate the spring collection area and open and prepare it for installation of the collection/piping system. Separate payment for trenching for these features will not be allowed.

13810.4.2 Measurement of drain gravel, rip-rap, bentonite, geotextile filter fabric, and the polyethylene liner shall be in the units of measurement shown on the BID Schedule.

13810.4.3 Measurement of collection piping shall be by the lineal foot of pipe installed, covered and backfilled, and includes grading and shaping of the spring site.

13810.4.3 Measurement of the concrete cut-off wall shall be for the number of cubic yards of concrete required for those structures, and any reinforcement or other required fixtures, in accordance with Section 03300.

13810.4.4 The spring collection box shall be measured as a "lump sum" which includes all concrete materials; all piping and fittings extending to the upstream outside surface of the box and downstream 5-feet from the outside surface of the box; including, the goose neck assemblies both on the spring box and on the discharge piping, the gravel base coarse material; the metal hatch and hardware; the weir and gage; and all grading other WORK necessary to complete the box. Also included under this bid item is the End Section and Screen for the overflow and drain piping.

13810.5 BASIS OF PAYMENT

13810.5.1 The accepted quantities will be paid for at the contract unit price for:

<u>PAY ITEM</u>	<u>UNIT</u>
Spring Exploration/Development	Hour
Drain Gravel	Cubic Yards per Section 02105
Bentonite	50 lb. Bag
Polyethylene Liner	Square Yard
(Size) Collection Pipe	Lineal Foot
Cutoff Wall	Cubic Yards per Section 03300
Collection Box	Lump Sum

DIVISION 15
MECHANICAL



15110.1 DESCRIPTION

This section is a materials specification and is included for guidance in selecting materials for pipe and related fittings and appurtenances used in the construction of water and sewer systems.

15110.1.1 RELATED WORK

Section 02222 - Waterline Pipe Installation
Section 02224 - Sewer Line Pipe Installation
Section 15230 - Waterline Valves and Hydrants
Section 15232 - Water System Control Valves

15110.1.2 SUBMITTALS

The CONTRACTOR shall submit for review complete information, showing all pipe, materials, fittings, gaskets, couplings, coatings, linings, supports, mechanical restraints, thrust blocks and configuration prior to the delivery of any components to the project. All information shall be provided in accordance with Section 01300 and written evidence of compliance from the manufacturer shall accompany each delivery of material.

15110.1.3 DEFINITIONS

Not used.

15110.2 MATERIALS**15110.2.1 NSF COMPLIANCE**

All pipe and materials furnished and installed for culinary use shall comply with NSF International Standard 61. Also, all plastic pipe must be approved by the NSF for potable water use and shall carry the factory "NSF" stamped label on the pipe indicating such approval.

15110.2.2 POLYVINYL CHLORIDE PIPE (PVC)**15110.2.2.1 PVC PIPE FOR WATER LINE CONSTRUCTION – Shall be as follows:**

- For sizes less than 4 inches OD, PVC pipe shall be Schedule Rated pressure pipe meeting the requirements of ASTM D1785 of the schedule and size shown on the Drawings.
- PVC pipe 4 inches and larger, shall be rigid, thermoplastic Class Rated pressure pipe meeting the requirements of ANSI/AWWA Standard C900 or C905 (latest revision). The pressure class or the dimensional ratio and the size shall be as shown on the Drawings.
- While Class Rated and Pressure Rated pipe materials are not interchangeable, when specifically allowed in the Contract Documents, for size 4" and larger, rigid thermoplastic Pressure Rated pressure pipe, meeting the requirements of ASTM D2241, may be furnished and installed. Operating pressure for this pipe shall be as shown on the Drawings.

15110.2.2.2 FITTINGS FOR PVC PIPE – Unless specifically authorized otherwise, fittings for 4 inch and larger size PVC pipe in underground service shall be ductile iron (DI) and shall meet the requirements of NSF 61 and ANSI/AWWA C-153. They shall have a standard coating of cement mortar on the interior surfaces in compliance with AWWA C-104. DI fittings meeting these requirements may be used with smaller PVC piping. PVC fittings meeting the requirements of

ANSI/AWWA C-907 may be used with PVC pipe smaller than 4 inches, and, in some instances, where specifically authorized, with PVC pipe sizes 4 inches through 8-inches.

15110.2.3 DUCTILE IRON PIPE

15110.2.3.1 INTERIOR COATING - The interior surface of all DI pipe shall be coated with a standard coating of cement-mortar in accordance with ANSI/AWWA Standard C-104 unless required otherwise in the Contract Documents. Field coating of DI pipe will not be acceptable.

15110.2.3.2 BURIED PIPE – Unless shown otherwise on the Drawings, shall be as follows:

- Buried ductile iron pipe shall be Thickness Class 51.
- Shall meet requirements of ANSI/AWWA C-151.
- Joints shall be bell and spigot or mechanical, which meet the requirements of ANSI/AWWA C-111.

15110.2.3.3 EXPOSED PIPE – Shall meet these requirements, unless shown otherwise on the Drawings:

- Exposed ductile iron pipe shall be Thickness Class 53.
- Pipe shall comply with ANSI/AWWA Standard C-151.
- Pipe joints shall be flanged, meeting the requirements of ANSI/AWWA C-115, or mechanical type couplings (MTC), meeting the requirements of ANSI/AWWA C-606. MTC shall be Victaulic grooved couplings, as manufactured by Victaulic Company of America or approved equal), unless shown otherwise on the drawings.
- 3” to 12” compact flanged fittings shall be ductile iron and shall be produced in accordance with laying lengths specified in ANSI/AWWA C10/A21.10. Flange surface shall be faced and drilled in accordance with ANSI Class 125 B16.1. Nominal body thickness shall be Manufacturer’s Standard, but shall not be less than those specified in ANSI/AWWA C153/A21.53 “Standards for Ductile Iron Compact Fittings”. Flange thickness shall be in accordance with the Manufacturer’s Standards. Working pressure rating shall be 250 psi for water. Fittings shall be made in the United States of America and shall not have been refurbished or reworked by anyone other than the manufacturer. When greater than 250 psi is called for on the Plans, then the Supplier shall furnish higher class rated flanges. Standard Class 125 template for drilling shall be used for all flanges. Drilling templates shall be in multiples of four, so that fittings may be made to face in any quarter. Boltholes shall straddle the centerline and shall be equally spaced. Misalignment of boltholes of two opposing flanges shall not exceed 0.12 inches. Blind flanges 12 inches and over shall be provided with lifting eyes. Insulated flanges shall be provided where required.
- Gaskets shall be full faced, 1/16-inch thick compressed sheets of Aramid fiber base, with nitrile binder and non stick coating, suitable for temperatures to 700°, pressures to 1000 psig and a pH range of 1 to 11. Blind flange gaskets shall cover the entire inside face of the flange and shall be cemented in place. Gaskets shall be as manufactured by John Crane, style 2160; Garlock, style 3000; or approved equal.

15110.2.4 HIGH DENSITY POLYETHYLENE PIPE (HDPE)

15110.2.4.1 PIPE – Shall be as follows:

- PE pipe shall be classified as a Type III, Grade P-34, Class C, Category 5, according to ASTM D1248. All PE pipe shall be manufactured according to ASTM D2513, D3035, F714, or API 15LE and AWWA C906.
- Pipe shall be made of high density, high molecular weight resin. PE plastic shall have a cell classification of 345434C as defined by ASTM D3350/AWWA C906. It shall be rated as PE3408 according to the requirements of the Plastics Pipe Institute. Internal pressure rating shall be as specified elsewhere in the project documents.

15110.2.4.2 **FITTINGS FOR HDPE** – Molded fittings shall be made of pre-blended virgin resins in accordance with the materials specifications of ASTM D1248. PE3408 fittings shall be made from a Type III, Class C, Category 5, Grade P-34 plastic resin having a cell classification of 345434C according to ASTM D3350. Socket fusion fittings shall be manufactured in compliance with ASTM D2683 and butt fusion fittings with ASTM D3261. Measurements of fittings shall be as required by ASTM D2122. All fittings shall be compatible for heat fusion with any pipe manufactured for like or similar resins.

Heat welded Flange Adapter Couplings shall be used for transition to other type piping material. The CONTRACTOR shall follow the manufacturer's recommendations, as well as specified procedures herein in fusing fittings to the polyethylene pipe.

15110.2.5 **GALVANIZED IRON PIPE AND FITTINGS**

Shall be of the schedule rating shown on the Drawings and shall be used only in exposed, non-corrosive atmospheres where piping diameters are less than 4 inches.

15110.2.6 **PIPE AND FITTINGS FOR WATER SERVICE LINES**

Shall meet the requirements provided in Section 15234 for water service connections.

15110.2.7 **PIPE FOR GRAVITY SEWER SYSTEMS**

Gravity sewer pipelines may be constructed with PVC or polyethylene (PE) plastic sewer pipe and fittings. Such materials shall be of the type, configuration and size shown on the Drawings and/or on the Bid Schedule.

15110.2.7.1 **PVC PIPE** - All PVC sewer pipe and fittings shall meet the standards of ASTM D3034 and F679. Such pipe shall be manufactured with a rubber gasketed joining system which meets ASTM D3212 and shall be furnished with a standard dimensional ratio of 35 (SDR 35) for wall thickness, unless shown otherwise on the Drawings.

15110.2.7.2 **PE PIPE** - All PE sewer pipe and shall be smooth, solid wall, high density polyethylene pipe manufactured from PE 3408 material conforming to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound equal to or exceeding the properties of the pipe being supplied.

15110.2.8 **PIPE FOR PRESSURE SEWER SYSTEMS**

Pressure sewer pipelines shall be constructed with DI, PVC, or PE plastic sewer pipe. Fittings and materials shall be of the type, SDR rating, (or pressure class) and size shown on the Drawings and/or on the Bid Schedule.

- 15110.2.8.1 PVC PIPE - All PVC pipe for pressure sewer lines shall be rigid, pressure rated, thermoplastic pipe which meets the standards of ASTM D2241. Fittings for PVC pipelines shall be Class 50, cement mortar lined, rubber gasketed, DI which meet the requirements of ANSI/AWWA C-153 and C-104.
- 15110.2.8.2 PE PIPE - PE pipe for pressure sewer lines shall be smooth, solid wall, high density polyethylene pipe manufactured from PE 3408 material conforming to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound equal to or exceeding the properties of the pipe being supplied.
- 15110.2.9 PIPE AND FITTINGS FOR IRRIGATION SYSTEMS
- Shall be either DI or Pressure Rated PVC, of the type and class shown on the Drawings, for line diameters 4-inches and greater. Buried lines smaller than 4 inches in diameter shall be Schedule Rated PVC as shown on the Drawings.
- 15110.2.10 PIPE FOR DRAIN SYSTEMS
- Piping for sub-drainage may be constructed with polyvinyl chloride (PVC) or polyethylene (PE) plastic non-pressure drainage or sewer pipe and fittings. Such materials shall be of the type, configuration and size shown on the Drawings and/or on the Bid Schedule.
- 15110.2.10.1 PVC PIPE - All PVC drainage pipe and fittings shall meet the standards of ASTM F794. Such pipe shall be manufactured with a rubber gasketed joining system which meets ASTM D3212 and may be furnished with ribbed, corrugated or smooth exterior walls with smooth interior wall surfaces, unless shown otherwise on the Drawings. Rubber gasketed joints will not be required for collection pipe applications with perforated or slotted pipe sections.
- 15110.2.10.2 PE PIPE - All PE drainage pipe shall be solid, corrugated or ribbed wall high-density polyethylene pipe with smooth interior wall surfaces. Material shall conform to ASTM D1248, Type III, Class C, Category 5, Grade P34 with a P3408 rating from the Plastic Pipe Institute. Fittings for this pipe shall be molded from a polyethylene compound and with equivalent properties and configurations specifically designed to fit the pipe being supplied.
- 15110.2.11 MISCELLANEOUS FITTINGS AND MATERIALS
- 15110.2.11.1 PIPE SUPPORTS - Floor mounted pipe supports for suspended, exposed piping systems shall be adjustable stanchion type supports designed to cradle the pipe diameter by 170 degrees. The support shall fit ductile iron or steel diameters snugly, without excessive gaps between the support and the pipe. Support saddle width shall be a minimum of 2 inches wide. The support must offer a minimum of 3 inches of final adjustment, after installation. Supports shall be supplied with independent base and adjustment collar designed to accept standard sized Schedule 40 galvanized steel pipe for coarse adjustment. Supports shall be fabricated from A36 mild steel, and shall have an electro-galvanized finish. Floor mounted pipe supports shall be the Standon Model S92 or C92 as manufactured by Material Resources, Inc., 22700 N. W. Quatama Street, Hillsboro, Oregon 97124, or approved equal. The standard required model shall be the S92. Non standard materials or model numbers shall be as specified on the Drawings.
- 15110.2.11.2 "Y" STRAINERS - shall be constructed of high-tensile ASTM A126 Class B Cast Iron with blow-off connections and self-aligning cylindrical screens and shall be equal to Watts Regulator Series 77F or better quality.

15110.2.11.3 FASTENERS – Fastener requirements are as follows:

- Unless otherwise required in these Specifications or shown on the Drawings, all bolting hardware for buried pipe, fittings, valves, and components shall be of manufacturer's standard materials.
- Unless otherwise required in these Specifications or shown on the Drawings, all bolting materials for exposed pipe, fittings, valves, and components shall be Type 316 stainless steel. Where space restrictions preclude the use of regular bolts, stainless steel threaded studs may be used on all valve flange connections.
- In all instances where stainless steel threaded fasteners are used, a coating of an approved, permanent anti-seize compound shall be applied to the fastener to prevent galling and to assist in disassembly.
- All bolts and/or studs shall extend through the nuts at least 1/4 inch.

15110.2.11.4 COUPLINGS – Couplings shall meet the following requirements:

- Unless prescribed otherwise on the Drawings or in these Specifications, couplings shall meet the requirements of ANSI/AWWA C-219. All flexible couplings shall meet the minimum requirements of Smith Blair 400 series.
- Sleeves shall have a smooth inside taper and there shall be no surface irregularities on any sealing surface. Gaskets shall be suitable for the project application.
- Flexible couplings for buried DI and PVC pipe sizes 2 through 16 inches in diameter shall be fabricated of steel or ductile iron. For pipe sizes larger than 16 inches, flexible couplings shall be of steel. Coupling components for use in potable water systems shall be factory coated with an FDA approved, bonded epoxy coating, applied to an average 12 mil thickness.
- Flexible couplings for exposed pipe shall be manufactured of steel, unless shown otherwise on the Drawings, or approved by the ENGINEER. Coupling components for use in potable water systems shall be factory coated with an FDA approved, fusion-bonded epoxy coating, applied to an average 12 mil thickness.

15110.2.11.5 RESTRAINT HARNESS – Where required, restraint harness for bell and spigot pipe joints shall be as manufactured by EBAA Iron Co. or an approved equal. The restraint shall consist of a split bell ring to go behind the bell and a split, serrated ring to grip the pipe on the other side of the joint. The harness shall be held together with clamping bolts and tie bolts. The rings shall be fabricated of 60-42-10 DI conforming to ASTM A-536. Clamping bolts shall be grade 5 galvanized machine bolts. Tie bolts are of low alloy steel. The harness shall have a minimum working pressure of 150 psi. Harness size shall be as shown in the schedule on the Drawings or as specified in the Special Provisions.

15110.2.11.6 VALVES AND FITTINGS - Shall be as specified in their respective sections in these Specifications.

15110.2.11.7 BOXES AND ENCLOSURES – Shall be of the size, type, and configuration indicated on the Drawings and Contract Documents.

15110.3 CONSTRUCTION REQUIREMENTS

See Sections 02222 and 02224 for construction requirements for applicable piping systems.

15110.4 METHOD OF MEASUREMENT

In general, fittings for pipe and piping systems are, and will be, considered appurtenant to the pipeline being installed unless specifically called out for separate payment on the Bid Schedule.

15110.5 BASIS OF PAYMENT

Not used.

15230.1 DESCRIPTION

This section covers furnishing and installing valves and fire hydrants in water transmission and distribution lines, together with fittings, thrust blocking, and boxes and enclosures related to the operating equipment.

15230.1.1 RELATED WORK

Section 02222 - Waterline Pipe Installation
Section 15110 - Pipe and Piping Systems
Section 15232 - Water System Control Valves

15230.1.2 SUBMITTALS

All information shall be provided in accordance with Section 01300. Written evidence of compliance from the manufacturer shall accompany each delivery of material.

15230.1.2.1 VALVES 12 INCHES AND SMALLER, AND HYDRANTS - For valve sizes 12-inches and smaller, and fire hydrants, the CONTRACTOR shall furnish the manufacturer's standard data and catalogues for review and approval.

15230.1.2.2 VALVES LARGER THAN 12 INCHES - For all valves sized larger than 12-inches, the CONTRACTOR shall furnish shop drawings and technical data prepared by the manufacturer for review and approval.

15230.1.2.3 CONTENT - Submittals shall include complete details, dimensions, weights, diameter of stems, alloy for all valve parts and any information that may be required to assemble, install, operate and maintain the valve.

15230.1.2.4 BUTTERFLY VALVES - Certification of performance together with leakage and hydrostatic tests as described in Section 13 of ASTM/AWWA C-504 shall be furnished to the ENGINEER upon the ENGINEER's request.

15230.1.2.5 BALL VALVES - Certification of performance together with leakage and hydrostatic tests as described in Section 5 of ASTM/AWWA C-507, shall be furnished top the ENGINEER upon the ENGINEER's request.

15230.1.3 DEFINITIONS

Not used.

15230.2 MATERIALS**15230.2.1 GATE VALVES**

15230.2.1.1 COMPLIANCE - All gate valves shall conform to AWWA C-500 or C-515 with the following characteristics:

15230.2.1.2 3-INCH AND SMALLER VALVES - Valves 3-inches and smaller shall be as follows:

- Valves shall be as manufactured by Ford, Hayes, Mueller, Red & White, or an approved equal.
- Valves shall be standard, double-disc, non-rising stem valves with wheel handles.
- Valve bodies shall be all bronze or brass.

- Valves shall be threaded, unless shown otherwise on the Drawings or required in these Specifications.

15230.2.1.3 GATE VALVES 4-INCH THROUGH 14-INCH - Gate valves 4-inches through 14-inches in size shall be as follows:

- Valves shall have a ductile iron body.
- Valves shall have a solid cast iron, rubber coated, wedge gate and a resilient seat.
- Gate shall be designed to work equally well with pressure on either side of it.
- Valves shall be of the non-rising stem type and shall be left hand opening (counter-clockwise) with a 2-inch square operating nut.
- All interior ferrous surfaces exposed to fluid flow shall have an NSF approved, fusion bonded, epoxy coating. Epoxy coatings shall be factory applied by an electrostatic or thermosetting process.

15230.2.1.4 GATE VALVES 16-INCHES AND LARGER - Gate valves 16-inches and larger shall be as follows:

- Valves shall be double-disc gate valves with flanged ends.
- Valves shall be manufactured in accordance with AWWA C-500. Bolts, nuts, studs, etc., used with the gear case also shall conform to the requirements for Bonnet Bolting in AWWA C-500.
- Valves shall have bevel gears and shall be actuated by 2-inch square operating nuts.
- The gears and stuffing box shall be enclosed in a watertight cast or ductile iron case for operation in buried location.
- The case shall be filled with grease at the factory.
- Valves shall be designed to operate in a horizontal orientation.
- Valves shall be equipped with bronze tracks, rollers and scrapers.
- By-pass valves shall be furnished with each valve mounted in position A as indicated in AWWA C-500.

15230.2.1.5 VALVES ON WATER MAINS - Valves on water mains shall have the following features:

- In-line valves shall have push-on or mechanical joints conforming to AWWA C-111.
- Valves attached to side outlets shall be flanged.
- By-pass valves shall be flanged.
- Valves in blow-off lines shall be flanged.
- Valves in fire hydrant lines shall have push-on or mechanical joints.
- Valves in air release and vacuum relief lines shall be flanged or threaded.

- Valves 12-inches and smaller shall be equipped with O-ring packing.

15230.2.2 BUTTERFLY VALVES

15230.2.2.1 **MANUFACTURER** - Butterfly valves shall be Dresser Industries "450", Allis-Chalmers "Streamseal", Henry Pratt "Groundhog", Mueller Linesal III, or an approved equal.

15230.2.2.2 **COMPLIANCE** - Butterfly valves shall conform to AWWA C-504.

15230.2.2.3 **CLASS** - Valves shall be Class 150 seated, tight closing valves, furnished with mechanical or flanged joints

15230.2.2.4 **SEATS** - Rubber valve seats shall be replaceable without disassembling the valve and shall not be interrupted by the shafting. Rubber seats may be retained on the disc edge by stainless steel clamping in lieu of bonding to the valve body.

15230.2.2.5 **SHAFT PACKING** - Shaft packing shall be of the self-adjusting permanent type.

15230.2.2.6 **OPERATION** - Underground opening and closing shall be accomplished with permanently lubricated screw-type operators, totally enclosed and of watertight construction. Overload protection shall be incorporated into the operator allowing the application of 450 foot-pounds input torque at full-open and full-closed positions without damage to the operator or valve. A 2-inch square wrench nut and valve box shall be provided for operating the valve. Valves shall open counter clockwise unless indicated otherwise in the Special Provisions.

15230.2.3 BALL VALVES

15230.2.3.1 **MANUFACTURER** - Valves shall be produced by a manufacturer having at least five years experience in the manufacture of water works and valves.

15230.2.3.2 **VALVES 4-INCHES AND LARGER** - Ball valves, 4-inches and larger, shall be ductile iron or cast-steel body, double seated valves meeting the requirements of ANSI/AWWA C-507.

15230.2.3.3 **SMALLER VALVES** - Smaller valves shall be stainless steel, bronze, or iron bodied valves of the size, type and class shown on the Drawings.

15230.2.4 CHECK VALVES

15230.2.4.1 **COMPLIANCE** - Check valves shall be manufactured in accordance with ANSI/AWWA C-508.

15230.2.4.2 **DESIGN** - Check valves shall be of a clear waterway, swing-check type. They shall be designed to be mounted horizontally. They shall be fitted with flanged ends for easy servicing. They shall have an iron body and be bronze mounted.

15230.2.4.3 **SEATING** - Valves shall be provided with a metal to resilient material seating.

15230.2.5 HOSE BIBS

Hose bibs shall be 3/4-inch bronze or brass body, Watts Model SC-1, Red & White Model RW 301 or approved equal. All hose bibs shall have a tee handle.

15230.2.6 SAMPLE FAUCET

Sample faucet shall be a 1/2-inch chromed or brass body hose bib without hose connection threads.

15230.2.7 FIRE HYDRANTS

15230.2.7.1 **COMPLIANCE** - Fire hydrants shall conform to standard for dry barrel fire hydrants, AWWA C-502 and modifications herein specified.

15230.2.7.2 **DESIGN** - Hydrants shall be designed as follows:

- Hydrants shall be of the "compression" or "toggle joint" type with safety flange and safety stem coupling above the ground line so that they can be repaired without shutting off the water.
- Hydrants shall be of the dry top design with two or more "O" rings sealing the water from the operating mechanism.
- Hydrants shall be furnished with 5-inch minimum valve openings, one 4 1/2-inch NST pumper connection and two 2 1/2-inch hose connections.
- Hose nozzle threads, pump nozzle threads, operating nut and opening direction shall match existing hydrants in the system.
- Hydrant lengths shall be designed for the cover depth shown on the Drawings plus the diameter of the main line pipe.

15230.2.7.3 **PAINTING** - The portion of the hydrant above the ground line shall be painted in accordance with the OWNER's standards.

15230.2.8 OPERATING WRENCHES

Unless notified otherwise by the ENGINEER, the CONTRACTOR shall furnish two, T-handle, operating wrenches for each project incorporating valves with 2-inch, square-head, operating nuts.

15230.2.9 VALVE BOXES

Valve boxes shall be cast iron, two piece, and adjustable valve boxes. Valve boxes shall be of the slip or screw type and be of sufficient length for the pipe burial depth required. The cast iron cover of the valve box shall have the word "water" stamped thereon.

15230.2.10 CONCRETE ENCLOSURES

Concrete enclosures for valves shall be precast and of the type, size and configuration shown on the Drawings and shall be fabricated in accordance with the requirements for precast concrete construction provided in Section 03500.

15230.3 CONSTRUCTION REQUIREMENTS**15230.3.1 SETTING VALVES AND VALVE BOXES**

All valves shall be set and jointed to the pipe in the manner described for pipe laying and jointing in Section 02222 of these Specifications. Valves shall be oriented with the operating nut vertical. Valve boxes shall be centered and plumb over the operating nut and shall be set so that no shock or stress will be transmitted to the valve. Tops of the valve boxes shall be set flush with the ground surface, concrete collars, or street surfacing, unless otherwise shown on the Drawings.

15230.3.2 VALVE RESTRAINT

Restraint shall be installed on all valves connected with slip-on, gasketed, or O-ring joints (i.e., bell & spigot, mechanical, etc.) in accordance with these Specifications and as shown on the Drawings.

15230.3.3 CONNECTING TO EXISTING MAINS

15230.3.3.1 CONNECTION TO EXISTING WORK - All connections to existing water mains shall be made by the CONTRACTOR, unless otherwise provided in these Specifications. The CONTRACTOR shall provide labor and materials, including special fittings and restraint devices, required to make the required connections between existing lines and new lines.

15230.3.3.2 INTERRUPTION OF SERVICES - Where the connection of new work to old requires interruption of service, the OWNER, ENGINEER and CONTRACTOR shall mutually agree upon a date for such connection which will allow ample time to assemble labor and materials and to notify all customers in accordance with Section 01510.

15230.3.4 FIRE HYDRANT INSTALLATION

15230.3.4.1 SETTING - All hydrants shall stand plumb use hand level with the pumper nozzle facing the street. The hydrant shall be set with the ground line at the location indicated by the hydrant manufacturer.

15230.3.4.2 DRAINAGE - Drainage shall be provided at the base of the hydrant by placing clean gravel under and around the base of the hydrant as shown on the Drawings.

15230.3.4.3 RESTRAINT - All hydrants shall be restrained by setting thrust blocks or mechanical restraint assemblies in accordance with the Drawings.

15230.3.4.4 AUXILIARY GATE VALVES - All fire hydrant assemblies shall include auxiliary gate valves positioned as shown on the Drawings.

15230.3.5 THRUST BLOCKS

Thrust blocks or joint restraints (Mega Lug) shall be formed to prevent coverage of the pipe joints in accordance with the details shown on the Drawings and as described in Section 03100 and 03050. All thrust blocks shall be set against undisturbed earth.

15230.4 METHOD OF MEASUREMENT**15230.4.1 VALVES**

Excavation, foundation preparation, restraint devices, valve boxes, backfill, and other miscellaneous devices, materials, or equipment required for installation shall be considered part of and included in the measurement of all valves and valve assemblies.

15230.4.1.1 NUMERICAL COUNT - When valves are installed as separate items or assemblies, the measurement shall be determined by counting the number of each size and type (including any associated valve box and concrete valve box collar) of valve installed and accepted.

15230.4.1.2 LUMP SUM - When valves are located in an enclosure, measurement shall be made as lump sum for the enclosure assembly and shall include the valve, any supplemental valves and fittings in the enclosure, and the enclosure.

15230.4.2 HYDRANTS

Measurement of hydrants shall be made by counting the number of hydrants set and accepted. For each hydrant, this measurement shall include the tee, shut-off gate valve, excavation and backfill, drain gravel, valve box and concrete collar, restraint, hydrant, and 5-feet of pipeline extending from the tee on the main line to the hydrant.

15230.4.3 NO SEPARATE MEASUREMENT

No separate measurement will be made for thrust blocks or other restraint provided with valves and fittings. Neither will separate measurement be approved for sample faucets and hose bibbs. Measurement for these items will be included with the quantity of the assembly whereon they are installed.

15230.5 BASIS OF PAYMENT

The accepted quantities will be paid for at the contract unit price.

PAY ITEM	UNIT
(<i>Size</i>) Gate Valve	Each
(<i>Size</i>) Ball Valve	Each
(<i>Size</i>) Ball Valve	Each
(<i>Size</i>) Butterfly Valve	Each
(<i>Size</i>) Check Valve	Each
Fire Hydrant Assembly	Each